P2219, 1901

ROSS' CELEBRATED LENSES

AND

ROSS AND GOERZ ANASTIGMATS, &c.

AN ABSOLUTELY UNRIVALLED SELECTION.

1901.

JANUARY	FEBRUARY	MARCH
[illegible]	[illegible]	[illegible]

APRIL	MAY	JUNE
[illegible]	[illegible]	[illegible]

JULY	AUGUST	[illegible]
[illegible]	[illegible]	[illegible]

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

THE 'UNAR' LENSES.

AN IMPORTANT NEW SERIES OF ROSS-ZEISS ANASTIGMATS.

ROSS' CELEBRATED LENSES

AND

ZEISS' AND GOERZ' ANASTIGMATS, &c.

AN ABSOLUTELY UNRIVALLED SELECTION.

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1901.

JANUARY.

S	M	T	W	T	F	S
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

FEBRUARY.

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	..	..
..	..	..	..	..	..	..

MARCH.

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	..	..	..	..	..	..

APRIL.

S	M	T	W	T	F	S
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	..	..	..	..
..	..	..	..	..	..	..

MAY.

S	M	T	W	T	F	S
..	..	..	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	..
..	..	..	..	..	..	..

JUNE.

S	M	T	W	T	F	S
..	..	..	..	..	..	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	..	..	..	..	..	..

JULY.

S	M	T	W	T	F	S
..	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	..	..	..
..	..	..	..	..	..	..

AUGUST.

S	M	T	W	T	F	S
..	..	..	..	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
..	..	..	..	..	..	..

SEPTEMBER.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	..	..	..	..	..
..	..	..	..	..	..	..

OCTOBER.

S	M	T	W	T	F	S
..	..	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	..	..
..	..	..	..	..	..	..

NOVEMBER.

S	M	T	W	T	F	S
..	..	..	..	..	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
..	..	..	..	..	..	..

DECEMBER.

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	..	..	..	..
..	..	..	..	..	..	..

POSTAL AND TELEGRAPHIC ADDRESSES,
1207 to 1217.

THE 'UNAR' LENSES.

AN IMPORTANT NEW SERIES

OF ROSS-ZEISS ANASTIGMATS.

See pages 35 to 98.

The 'LONDON' PLATES

Prices and Particulars of all Dealers or direct from the Manufacturers,

WRATTEN & WAINWRIGHT,

CROYDON, SURREY.

JANUARY.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	Tu		8 8	3 59	1 6	4 12
2	W		8 8	4 0	1 55	5 23
3	Th	Prof. J. W. Draper d. 1882	8 8	4 1	2 53	6 25
4	F		8 8	4 2	3 59	7 16
5	S	○ 0.14 M.	8 8	4 3	5 9	7 57
6	S	Epiphany	8 8	4 4	6 21	8 30
7	M	Daguerreotype com. to Acad. of Sc.	8 7	4 5	7 32	8 57
8	Tu	[(Paris), 1839	8 7	4 7	8 41	9 20
9	W		8 6	4 8	9 47	9 40
10	Th		8 6	4 10	10 52	9 59
11	F		8 5	4 11	11 58	10 19
12	S	☾ 8.38 A.	8 5	4 13	Morn	10 40
13	S	1st Sun. aft. Epiphany. William	8 4	4 14	1 4	11 2
14	M	[Bedford d. 1893	8 3	4 16	2 8	11 27
15	Tu	G. W. Simpson d. 1880	8 2	4 17	3 12	11 59
16	W		8 1	4 19	4 14	After
17	Th		8 0	4 20	5 12	1 28
18	F	E. Lacan d. 1879. Rejlander d. 1875	7 59	4 22	6 3	2 26
19	S	[Soc. of Lond. f. 1853. ● 2.36 A.	7 58	4 23	6 48	3 34
20	S	2nd Sun. aft. Epiphany. Photo.	7 57	4 25	7 25	4 48
21	M	Fox Talbot b. 1800	7 56	4 27	7 56	6 5
22	Tu	Sir W. Newton d. 1869	7 55	4 29	8 23	7 25
23	W		7 54	4 30	8 47	8 45
24	Th		7 53	4 32	9 11	10 5
25	F		7 52	4 34	9 35	11 24
26	S		7 51	4 36	10 2	Morn
27	S	3rd Sun. aft. Epiphany. ☽ 9.52 M.	7 49	4 37	10 33	0 43
28	M	Photo-sculpture pat. by Willème,	7 48	4 39	11 8	2 1
29	Tu	[1863	7 46	4 41	11 51	3 12
30	W	Fox Talbot's first communication to	7 45	4 43	After	4 16
31	Th	[Royal Soc. 1839	7 43	4 44	1 46	5 10

RESIDUES

Reduce every description of PHOTOGRAPHIC RESIDUES,

CONSIGNMENTS AND REMITTANCES PUNCTUALLY ATTENDED TO.

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THORNTON-PICKARD
TIME & INST.
SHUTTER
THE FIRST
AND
THE BEST.
SEE
PAGES
1223
to
1278

JANUARY.

D. M.	D. W.	MEMORANDA.
1	Tu	*For* MEETINGS OF SOCIETIES, *see pp.* 603–655.
2	W	
3	Th	
4	F	
5	S	
6	S	
7	M	
8	Tu	
9	W	
10	Th	
11	F	
12	S	
13	S	
14	M	
15	Tu	
16	W	
17	Th	
18	F	
19	S	
20	S	
21	M	
22	Tu	
23	W	
24	Th	
25	F	
26	S	
27	S	
28	M	
29	Tu	
30	W	
31	Th	

RESIDUES
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Chloride of Gold
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FEBRUARY.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	F		7 42	4 46	2 54	5 55
2	S		7 41	4 48	4 2	6 29
3	S	Septuagesima Sunday. ○ 3.30 A.	7 39	4 50	5 13	6 59
4	M		7 38	4 52	6 23	7 23
5	Tu		7 36	4 53	7 30	7 44
6	W		7 34	4 55	8 38	8 5
7	Th		7 32	4 57	9 43	8 25
8	F	Calotype Process pat. 1841	7 31	4 59	10 47	8 45
9	S		7 29	5 1	11 52	9 6
10	S	Sexagesima Sunday. Sir David	7 27	5 3	Morn	9 30
11	M	☾ 6.12 A. [Brewster d. 1868	7 25	5 4	0 56	10 0
12	Tu		7 24	5 6	1 57	10 35
13	W	Leon Foucault d. 1868	7 22	5 8	2 56	11 18
14	Th	St. Valentine	7 20	5 10	3 50	After
15	F		7 18	5 12	4 37	1 13
16	S		7 16	5 14	5 18	2 23
17	S	Quinquagesima (Shrove) Sunday	7 14	5 15	5 53	3 39
18	M	Moule's Photogen (artificial light for	7 12	5 17	6 22	5 0
19	Tu	● 2.45 M. [portraiture) pat. 1857	7 10	5 19	6 49	6 21
20	W	Poitevin's p. of Helioplastie pub.	7 8	5 21	7 13	7 44
21	Th	[1855	7 6	5 23	7 39	9 6
22	F		7 4	5 25	8 5	10 28
23	S		7 2	5 26	8 35	11 47
24	S	1st Sunday in Lent	7 0	5 28	9 10	Morn
25	M	☽ 6.38 A.	6 58	5 30	9 52	1 2
26	Tu	Senefelder d. 1834. Padre Secchi d.	6 56	5 32	10 43	2 9
27	W	[1876. Arago b. 1786	6 54	5 33	11 41	3 7
28	Th		6 52	5 35	After	3 53

RESIDUES

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THE THORNTON-PICKARD TIME EXPOSURE VALVE
GIVES EXPOSURE AUTOMATICALLY from ⅛th to 3 seconds.
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FEBRUARY.

D. M.	D. W.	MEMORANDA.
1	F	*For* Meetings of Societies, *see pp.* 603–655.
2	S	
3	S	
4	M	
5	Tu	
6	W	
7	Th	
8	F	
9	S	
10	S	
11	M	
12	Tu	
13	W	
14	Th	
15	F	
16	S	
17	S	
18	M	
19	Tu	
20	W	
21	Th	
22	F	
23	S	
24	S	
25	M	
26	Tu	
27	W	
28	Th	

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'ORDINARY,' **'LONDON'**

for Landscapes, Copying, &c. **PLATES.**

MARCH.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	F		6 49	5 37	1 52	4 31
2	S		6 47	5 39	3 2	5 2
3	S	2nd Sunday in Lent	6 45	5 40	4 10	5 27
4	M	Poitevin d. 1882	6 43	5 42	5 18	5 49
5	Tu	La Place d. 1827. J. Albert b. 1825.	6 41	5 44	6 24	6 10
6	W	Fraunhofer b. 1787 [○ 8.4 M.	6 39	5 46	7 29	6 30
7	Th	J. N. Niepce b. 1765. Herschel b. 1792	6 36	5 47	8 36	6 50
8	F		6 34	5 49	9 40	7 11
9	S	G. W. Wilson d. 1893	6 32	5 51	10 43	7 34
10	S	3rd Sunday in Lent	6 30	5 53	11 45	8 3
11	M	St. Claire Deville b. 1818	6 27	5 54	Morn	8 34
12	Tu		6 25	5 56	0 45	9 14
13	W	☾ 1.6 A.	6 23	6 58	1 39	10 1
14	Th	Herschel int. hypo for fixing, 1839	6 21	6 0	2 27	10 57
15	F		6 18	6 1	3 10	After
16	S		6 16	6 3	3 47	1 13
17	S	4th Sunday in Lent	6 14	6 4	4 18	2 31
18	M		6 12	6 6	4 47	3 50
19	Tu	Thomas Sutton d. 1875	6 10	6 7	5 13	5 12
20	W	● 0.53 A.	6 8	6 8	5 38	6 36
21	Th		6 5	6 10	6 4	8 1
22	F		6 3	6 13	6 34	9 24
23	S		6 0	6 15	7 8	10 44
24	S	5th Sunday in Lent. Becquerel	5 58	6 17	7 49	11 57
25	M	Hermagis d. 1868 [b. 1820	5 56	6 18	8 38	Morn
26	Tu		5 54	6 20	9 35	1 0
27	W	☽ 4.39 M.	5 51	6 21	10 38	1 51
28	Th	La Place b. 1749	5 49	6 23	11 46	2 31
29	F		5 46	6 24	After	3 4
30	S		5 44	6 26	2 3	3 31
31	S	Palm Sunday	5 42	6 28	3 10	3 55

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SHUTTER
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Instantaneous Exposures.
SEE
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MARCH

D. M.	D. W.	MEMORANDA
1	F	
2	S	*For* MEETINGS OF SOCIETIES, *see pp.* 603-655.
3	S	
4	M	
5	Tu	
6	W	
7	Th	
8	F	
9	S	
10	S	
11	M	
12	Tu	
13	W	
14	Th	
15	F	
16	S	
17	S	
18	M	
19	Tu	
20	W	
21	Th	
22	F	
23	S	
24	S	
25	M	
26	Tu	
27	W	
28	Th	
29	F	
30	S	

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PLATES.

APRIL.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	M		5 40	6 29	4 15	4 16
2	Tu	First Sun Pho. by Fizeau and Fou-	5 38	6 31	5 21	4 35
3	W	[cault, 1845. Morse d. 1872	5 35	6 33	6 25	4 55
4	Th	○ 1.20 M. [1801. Isid. Niepce b. 1795	5 33	6 35	7 29	5 16
5	F	**Good Friday.** Rev. J. B. Reade b.	5 30	6 36	8 33	5 40
6	S	[Niepce de St. Victor d. 1870	5 28	6 38	9 36	6 5
7	S	**Easter Sun.** Voigtländer d. 1878.	5 26	6 39	10 36	6 36
8	M	[1839	5 24	6 41	11 32	7 13
9	Tu	Fox Talbot's First Art. in *Athenæum*,	5 21	6 43	Morn	7 57
10	W	Pouncy's Carb. Process pat. 1858.	5 19	6 45	0 22	8 50
11	Th	[Clarence Fry d. 1897	5 17	6 46	1 5	9 49
12	F	☾ 3.57 M.	5 15	6 48	1 43	10 55
13	S		5 13	6 50	2 16	After
14	S	**Low Sunday**	5 11	6 52	2 44	1 23
15	M		5 8	6 53	3 11	2 42
16	Tu		5 6	6 55	3 36	4 3
17	W	Fargier's Carbon Process pat. 1861	5 4	6 56	4 1	5 27
18	Th	● 9.37 A.	5 2	6 58	4 30	6 52
19	F	Warren de la Rue d. 1889	5 0	7 0	5 1	8 15
20	S		4 58	7 2	5 40	9 35
21	S	**2nd Sun. after Easter.** Talbot's	4 56	7 3	6 27	10 44
22	M	[Photo.-etch. Proc. pat. 1858	4 54	7 5	7 22	11 42
23	Tu		4 51	7 6	8 26	Morn
24	W	Celsius d. 1744	4 49	7 8	9 34	0 28
25	Th	'Sun-blinds' pat. 1862. ☽ 4.15 A.	4 47	7 10	10 44	1 5
26	F	Adam Salomon d. 1881	4 45	7 11	11 54	1 35
27	S		4 43	7 13	After	1 59
28	S	**3rd Sun. after Easter.** M. Carey	4 42	7 15	2 7	2 21
29	M	[Lea d. 1897	4 40	7 17	3 12	2 41
30	Tu	Colonel Stuart Wortley d. 1890	4 38	7 18	4 16	3 1

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IN
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APRIL.

D. M.	D. W.	MEMORANDA.
1	M	*For* Meetings of Societies, *see pp.* 603–655.
2	Tu	
3	W	
4	Th	
5	F	
6	S	
7	**S**	
8	M	
9	Tu	
10	W	
11	Th	
12	F	
13	S	
14	**S**	
15	M	
16	Tu	
17	W	
18	Th	
19	F	
20	S	
21	**S**	
22	M	
23	Tu	
24	W	
25	Th	
26	F	
27	S	
28	**S**	
29	M	
30	Tu	

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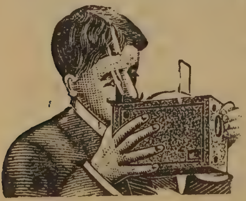
MAY.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	W		4 36	7 19	5 21	3 22
2	Th		4 34	7 21	6 25	3 44
3	F	○ 6.19 A.	4 32	7 22	7 28	4 9
4	S	Senebier b. 1742	4 30	7 24	8 29	4 38
5	S	4th S. aft. Easter. J. W. Draper	4 28	7 26	9 27	5 13
6	M	Humboldt d. 1859 [b. 1811	4 27	7 28	10 20	5 55
7	Tu		4 25	7 29	11 5	6 45
8	W	Peroxide of H. rec. for rem. of Hypo,	4 23	7 31	11 43	7 43
9	Th	[1866. P. Meagher d. 1897	4 21	7 32	Morn	8 46
10	F		4 20	7 34	0 17	9 55
11	S	Becquerel d. 1891. ☾ 2.38 A.	4 18	7 35	0 45	11 7
12	S	Rogation Sun. Sir John Herschel	4 17	7 37	1 12	After
13	M	J. v. Liebig b. 1803 [d. 1871. W.B.	4 15	7 38	1 37	1 39
14	Tu	Fahrenheit b. 1686 [Bolton d. 1899	4 14	7 40	2 1	2 58
15	W	[d. 1887	4 12	7 41	2 27	4 20
16	Th	Ascension Day. Major C. Russell	4 11	7 43	2 56	5 43
17	F	Association Belge founded, 1874	4 9	7 44	3 31	7 5
18	S	● 5.38 M.	4 8	7 46	4 13	8 20
19	S	Sunday after Ascension	4 6	7 47	5 5	9 27
20	M		4 4	7 49	6 7	10 20
21	Tu	Scheele d. 1786	4 3	7 50	7 15	11 1
22	W		4 2	7 52	8 26	11 35
23	Th	B. J. Sayce d. 1895	4 1	7 53	9 39	Morn
24	F		4 0	7 54	10 48	0 2
25	S	☽ 5.40 M.	3 58	7 56	11 57	0 26
26	S	Whit Sunday	3 57	7 57	After	0 47
27	M		3 56	7 58	2 8	1 6
28	Tu		3 55	8 0	3 12	1 27
29	W	Sir H. Davy d. 1829	3 54	8 1	4 16	1 49
30	Th		3 53	8 2	5 20	2 12
31	F		3 52	8 3	6 22	2 40



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MAY.

D. M.	D. W.	MEMORANDA.
1	W	*For* Meetings of Societies, *see pp.* 603–655.
2	Th	
3	F	
4	S	
5	**S**	
6	M	
7	Tu	
8	W	
9	Th	
10	F	
11	S	
12	**S**	
13	M	
14	Tu	
15	W	
16	Th	
17	F	
18	S	
19	**S**	
20	M	
21	Tu	
22	W	
23	Th	
24	F	
25	S	
26	**S**	
27	M	
28	Tu	
29	W	
30	Th	
31	F	

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JUNE.

D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	S		3 52	8 4	7 21	3 14
2	S	Trin. Sun. Niepce pub. his *Helio-*	3 51	8 5	8 15	3 52
3	M	[*chromic Processes*, 1851. ○ 9.53 M.	3 50	8 6	9 3	4 41
4	Tu	Tessié du Mothay d. 1880	3 50	8 7	9 45	5 35
5	W		3 49	8 8	10 20	6 38
6	Th		3 49	8 9	10 51	7 45
7	F	Fraunhofer d. 1826	3 48	8 10	11 17	8 56
8	S		3 48	8 11	11 42	10 10
9	S	1st Sunday after Trinity. Alvan	3 47	8 11	Morn	11 24
10	M	[Clark d. 1897. ☾ 10.0 A.	3 47	8 12	0 5	After
11	Tu	Cutting's American Bromide pat.	3 46	8 13	0 30	1 59
12	W	[1853	3 46	8 14	0 56	3 19
13	Th		3 45	8 14	1 26	4 39
14	F	Partnership between Daguerre and	3 45	8 15	2 4	5 56
15	S	[Niepce, 1837	3 45	8 15	2 50	7 7
16	S	2nd S. aft. Trinity. Chrysotype	3 45	8 16	3 45	8 6
17	M	[and Cyanotype Pro. com. to	3 44	8 16	4 52	8 55
18	Tu	[Royal Soc., 1842. ● 1.33 A.	3 44	8 17	6 2	9 32
19	W	Abbé Laborde d. 1883	3 44	8 17	7 16	10 3
20	Th		3 44	8 18	8 29	10 29
21	F	Niepce Memorial uncov. at Chalons,	3 45	8 18	9 40	10 51
22	S	[1885	3 45	8 18	10 49	11 11
23	S	3rd Sun. after Trinity. ☽ 8.59 A.	3 45	8 18	11 55	11 32
24	M	Hardwich d. 1890	3 45	8 19	After	11 54
25	Tu	[b. 1839	3 46	8 19	2 5	Morn
26	W	W. B. Woodbury b. 1834. Liesegang	3 46	8 19	3 9	0 16
27	Th	Herr Wothly d. 1873. G. Price d.	3 46	8 19	4 12	0 43
28	F	[1870	3 46	8 19	5 12	1 13
29	S	Ferrous-oxalate Developer pub. 1877	3 47	8 19	6 8	1 51
30	S	4th Sunday after Trinity	3 48	8 18	7 0	2 35

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JUNE.

D. M.	D. W.	MEMORANDA.
1	S	
2	S	*For* MEETINGS OF SOCIETIES, *see pp.* 603–655.
3	M	
4	Tu	
5	W	
6	Th	
7	F	
8	S	
9	S	
10	M	
11	Tu	
12	W	
13	Th	
14	F	
15	S	
16	S	
17	M	
18	Tu	
19	W	
20	Th	
21	F	
22	S	
23	S	
24	M	
25	Tu	
26	W	
27	Th	
28	F	
29	S	
30	S	

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JULY.

D. M.	D. W.	Remarkable Events.		Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	M		○ 11.18 A.	3 49	8 18	7 44	3 28
2	Tu			3 49	8 18	8 21	4 28
3	W			3 50	8 18	8 55	5 35
4	Th			3 50	8 17	9 23	6 45
5	F	Nicephore Niepce d. 1833		3 51	8 17	9 48	7 59
6	S			3 52	8 16	10 12	9 14
7	S	5th Sunday after Trinity		3 53	8 16	10 36	10 30
8	M			3 54	8 15	11 1	11 46
9	Tu		☾ 3.20 M.	3 55	8 14	11 30	After
10	W	Daguerre d. 1851		3 56	8 13	Morn	2 22
11	Th			3 57	8 13	0 3	3 38
12	F	Wedgwood b. 1730. G. Dawson d.		3 58	8 12	0 44	4 49
13	S	Abbé Moigno d. 1884 [1897		3 59	8 11	1 32	5 53
14	S	6th S. aft. Trinity. Dumas b. 1800		4 0	8 10	2 34	6 45
15	M		● 10.11 A.	4 1	8 9	3 42	7 28
16	Tu	Claudet b. 1797		4 2	8 8	4 53	8 3
17	W			4 4	8 7	6 6	8 30
18	Th	V. M. Griswold (Inv. Ferrotype) d.		4 5	8 6	7 19	8 54
19	F	[1872		4 6	8 5	8 30	9 16
20	S	Collodion Pos. Process pub. 1852		4 7	8 4	9 37	9 38
21	S	7th Sun. after Trinity. Regnault		4 9	8 3	10 45	9 59
22	M	[b. 1810		4 10	8 2	11 50	10 21
23	Tu		☽ 1.58 A.	4 11	8 1	After	10 45
24	W	Sir William Abney b. 1843		4 12	7 59	1 58	11 14
25	Th			4 14	7 58	2 59	11 49
26	F	Niepce de St. Victor b. 1806		4 15	7 56	3 57	Morn
27	S			4 17	7 55	4 50	0 29
28	S	8th Sunday after Trinity		4 18	7 54	5 38	1 18
29	M	Secchi b. 1818		4 20	7 53	6 19	2 15
30	Tu			4 21	7 51	6 55	3 21
31	W	Wohler b. 1800.	○ 10.34 M.	4 23	7 50	7 26	4 30

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JULY.

D. M.	D. W.	MEMORANDA.
1	M	
2	Tu	*For* MEETINGS OF SOCIETIES, *see pp.* 603–655.
3	W	
4	Th	
5	F	
6	S	
7	S	
8	M	
9	Tu	
10	W	
11	Th	
12	F	
13	S	
14	S	
15	M	
16	Tu	
17	W	
18	Th	
19	F	
20	S	
21	S	
22	M	
23	Tu	
24	W	
25	Th	
26	F	
27	S	
28	S	
29	M	
30	Tu	
31	W	

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AUGUST.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	Th		4 24	7 48	7 52	5 44
2	F		4 25	7 46	8 17	7 0
3	S	Mungo Ponton d. 1880	4 27	7 44	8 41	8 17
4	S	9th Sunday after Trinity	4 28	7 42	9 6	9 35
5	M	Wollaston b. 1766. W. K. Burton	4 30	7 41	9 34	10 52
6	Tu	[d. 1899	4 31	7 39	10 5	After
7	W	Berzelius d. 1848. ☾ 8.2 M.	4 33	7 37	10 44	1 27
8	Th	Roger Fenton d. 1869	4 34	7 35	11 30	2 38
9	F		4 36	7 34	Morn	3 43
10	S	W. H. Harrison d. 1897	4 37	7 32	0 24	4 39
11	S	10th Sunday after Trinity	4 39	7 30	1 26	5 23
12	M		4 41	7 28	2 36	6 0
13	Tu	Prof. Stokes b. 1819	4 43	7 26	3 48	6 31
14	W	Daguerreotype Process pat. 1839.	4 44	7 24	5 0	6 56
15	Th	[● 8.28 M.	4 46	7 22	6 11	7 20
16	F	Lavoisier b. 1743	4 47	7 20	7 20	7 42
17	S		4 49	7 18	8 28	8 3
18	S	11th S. aft. Trinity. Dr. Wood-	4 50	7 16	9 34	8 24
19	M	[ward (photo-microscopist) d. 1884	4 52	7 14	10 40	8 48
20	Tu		4 53	7 12	11 44	9 16
21	W	Chevreul b. 1786	4 55	7 10	After	9 47
22	Th	☽ 7.52 M.	4 56	7 8	1 44	10 25
23	F	[1867	4 58	7 6	2 40	11 10
24	S	Cutting (Introd. of Ambrotype) d.	5 0	7 4	3 29	Morn
25	S	12th S. aft. Trin. Faraday d. 1867	5 2	7 2	4 13	0 3
26	M	Paul Pretsch d. 1873. Daguerre	5 3	7 0	4 50	1 3
27	Tu	[Mem. uncovered, 1883	5 5	6 58	5 24	2 10
28	W		5 6	6 56	5 53	3 23
29	Th	○ 8.21 A.	5 8	6 54	6 19	4 38
30	F	Oliver Sarony d. 1879	5 9	6 51	6 44	5 56
31	S	Helmholtz b. 1821	5 11	6 48	7 10	7 16

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AUGUST.

D. M.	D. W.	MEMORANDA.
1	Th	*For* Meetings of Societies, *see pp.* 603–655.
2	F	
3	S	
4	**S**	
5	M	
6	Tu	
7	W	
8	Th	
9	F	
10	S	
11	**S**	
12	M	
13	Tu	
14	W	
15	Th	
16	F	
17	S	
18	**S**	
19	M	
20	Tu	
21	W	
22	Th	
23	F	
24	S	
25	**S**	
26	M	
27	Tu	
28	W	
29	Th	
30	F	
31	S	

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SEPTEMBER.

D. M.	D. W.	Remarkable Events.	Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	S	13th Sun. aft. Trinity. Norris's	5 13	6 46	7 38	8 37
2	M	[Dry-plate Process pat. 1856	5 14	6 44	8 9	9 57
3	Tu		5 16	6 42	8 45	11 14
4	W	Woodbury d. 1885	5 17	6 40	9 29	After
5	Th	Pantascopic Camera patented, 1862.	5 19	6 38	10 21	1 36
6	F	☾ 1.27 A.	5 20	6 35	11 20	2 34
7	S	Poitevin Memorial inaugurated, 1885	5 22	6 33	Morn	3 22
8	S	14th S. aft. Trin. Gel.-bro. Pro.	5 23	6 31	0 27	4 1
9	M	Col.-bro. Pro. pub. 1864 [pub. by	5 25	6 29	1 37	4 33
10	Tu	[Maddox, 1871	5 27	6 26	2 47	5 0
11	W		5 29	6 24	3 58	5 24
12	Th	● 9.19 A.	5 30	6 22	5 6	5 46
13	F		5 32	6 20	6 13	6 8
14	S	Humboldt b. 1769	5 33	6 17	7 21	6 29
15	S	15th S. aft. Trin. Petzval d. 1891	5 35	6 15	8 26	6 53
16	M		5 36	6 13	9 30	7 18
17	Tu	Fox Talbot d. 1877	5 38	6 11	10 32	7 48
18	W	Leon Foucault b. 1819	5 39	6 8	11 32	8 24
19	Th	T. Grubb d. 1878	5 41	6 6	After	9 4
20	F	Talbot's Discovery of Develop. 1840	5 42	6 3	1 19	9 53
21	S	Stas b. 1813. ☽ 1 33 M.	5 44	6 2	2 5	10 50
22	S	16th S. aft. Trin. Faraday b. 1791.	5 46	5 59	2 45	11 52
23	M	Woodbury Pro. pat. 1864 [Thos. Sut-	5 48	5 57	3 20	Morn
24	Tu	[ton b. 1819	5 49	5 54	3 50	1 0
25	W	Dr. Van Monckhoven b. 1834, d. 1882	5 51	5 52	4 18	2 14
26	Th		5 52	5 49	4 44	3 30
27	F	Kolbe b. 1818	5 54	5 47	5 11	4 49
28	S	○ 5 36 M.	5 55	5 45	5 37	6 10
29	S	17th Sunday after Trinity	5 57	5 43	6 9	7 32
30	M	Balard (Discoverer of Bromine) b. [1802	5 59	5 40	6 43	8 54

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SEPTEMBER.

D. M.	D. W.	MEMORANDA.
1	S	*For* Meetings of Societies, *see pp.* 603–655.
2	M	
3	Tu	
4	W	
5	Th	
6	F	
7	S	
8	S	
9	M	
10	Tu	
11	W	
12	Th	
13	F	
14	S	
15	S	
16	M	
17	Tu	
18	W	
19	Th	
20	F	
21	S	
22	S	
23	M	
24	Tu	
25	W	
26	Th	
27	F	
28	S	
29	S	
30	M	

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OCTOBER.

D. M.	D. W.	Remarkable Events.		Sun. Rises. H. M.	Sun. Sets. H. M.	Moon. Rises. After.	Moon. Sets. Morn.
1	Tu			6 1	5 38	7 26	10 13
2	W	Arago d. 1853		6 2	5 36	8 17	11 26
3	Th			6 4	5 32	9 16	After
4	F		☾ 8.52 A.	6 5	5 31	10 20	1 19
5	S			6 7	5 29	11 29	2 1
6	S	18th Sunday after Trinity		6 9	5 27	Morn	2 36
7	M	Leon Warnerke d. 1900		6 11	5 25	0 39	3 4
8	Tu			6 12	5 22	1 48	3 29
9	W			6 14	5 20	2 57	3 51
10	Th			6 15	5 18	4 4	4 13
11	F			6 17	5 16	5 9	4 34
12	S	Gmelin b. 1792.	● 1.11 A.	6 19	5 13	6 15	4 57
13	S	19th Sunday after Trinity		6 21	5 11	7 20	5 23
14	M			6 22	5 9	8 23	5 51
15	Tu			6 24	5 7	9 24	6 23
16	W	[1887		6 26	5 5	10 21	7 2
17	Th	Reaumur d. 1757. Robert Hunt d.		6 28	5 3	11 14	7 48
18	F	Schonbein b. 1799. Wheatstone d.		6 29	5 0	After	8 40
19	S	[1875		6 31	4 58	0 41	9 39
20	S	20th Sun. aft. Trinity.	☽ 5.58 A.	6 33	4 56	1 17	10 44
21	M			6 35	4 54	1 48	11 53
22	Tu			6 36	4 52	2 16	Morn
23	W			6 38	4 50	2 43	1 5
24	Th			6 40	4 48	3 7	2 20
25	F	Vernon Heath d. 1895		6 42	4 46	3 34	3 39
26	S			6 43	4 44	4 2	4 59
27	S	21st Sun. aft. Trinity.	○ 3.6 A.	6 45	4 42	4 35	6 23
28	M	Col.-chlo. of Silver Process pub. 1864		6 47	4 40	5 16	7 46
29	Tu	Talbot Photo-eng. Process pat. 1852		6 49	4 39	6 4	9 3
30	W			6 50	4 37	7 2	10 14
31	Th			6 52	4 35	8 7	11 12

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OCTOBER.

D. M.	D. W.	MEMORANDA.
1	Tu	*For* Meetings of Societies, *see pp.* 603–655.
2	W	
3	Th	
4	F	
5	S	
6	S	
7	M	
8	Tu	
9	W	
10	Th	
11	F	
12	S	
13	S	
14	M	
15	Tu	
16	W	
17	Th	
18	F	
19	S	
20	S	
21	M	
22	Tu	
23	W	
24	Th	
25	F	
26	S	
27	S	
28	M	
29	Tu	
30	W	
31	Th	

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NOVEMBER.

D. M.	D. W.	Remarkable Events.	SUN. Rises. H. M.	SUN. Sets. H. M.	MOON. Rises. After.	MOON. Sets. Morn.
1	F		6 54	4 33	9 17	11 59
2	S		6 55	4 31	10 28	After
3	S	22nd Sun. aft. Trinity. ☾ 7.24 M.	6 57	4 29	11 40	1 8
4	M		6 59	4 27	Morn	1 33
5	Tu		7 1	4 26	0 50	1 56
6	W	Senefelder b. 1771	7 3	4 24	1 56	2 18
7	Th	Dubois Raymond b. 1818	7 5	4 23	3 2	2 39
8	F	J. Traill Taylor d. 1895. [Sarony d. 1896	7 6	4 21	4 6	3 1
9	S	Pretsch's Pho.-eng. Pro. pat. 1854. N.	7 8	4 19	5 10	3 25
10	S	23rd S. aft. Trin. Laroche d. 1886	7 10	4 17	6 14	3 53
11	M	Willis's Aniline Process pat. 1864.	7 12	4 16	7 17	4 24
12	Tu	[● 7.34 M.	7 13	4 14	8 14	5 1
13	W		7 15	4 13	9 9	5 44
14	Th		7 17	4 11	9 58	6 35
15	F		7 19	4 10	10 41	7 31
16	S	Lavater d. 1741	7 20	4 9	11 17	8 32
17	S	24th Sunday after Trinity	7 22	4 8	11 50	9 37
18	M	Daguerre b. 1787	7 24	4 6	After	10 47
19	Tu	☽ 8.23 M.	7 26	4 5	0 44	11 59
20	W	Prof. Draper d. 1882	7 27	4 4	1 8	Morn
21	Th		7 29	4 3	1 33	1 13
22	F	Schlippe b. 1749	7 30	4 1	1 58	2 31
23	S	Harrison (Inv. of Globe Lens) d. 1864	7 32	4 0	2 29	3 50
24	S	25th Sunday after Trinity	7 34	3 59	3 5	5 11
25	M		7 36	3 58	3 49	6 33
26	Tu	○ 1.18 M.	7 37	3 57	4 42	7 49
27	W	Celsius b. 1701	7 39	3 56	5 45	8 55
28	Th	Sutton Panoramic Camera pat. 1859	7 40	3 55	6 55	9 50
29	F		7 42	3 55	8 10	10 33
30	S		7 43	3 54	9 23	11 8

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NOVEMBER.

D. M.	D. W.	MEMORANDA.
1	F	*For* MEETINGS OF SOCIETIES, *see pp.* 603–655.
2	S	
3	S	
4	M	
5	Tu	
6	W	
7	Th	
8	F	
9	S	
10	S	
11	M	
12	Tu	
13	W	
14	Th	
15	F	
16	S	
17	S	
18	M	
19	Tu	
20	W	
21	Th	
22	F	
23	S	
24	S	
25	M	
26	Tu	
27	W	
28	Th	
29	F	
30	S	

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D. M.	D. W.	REMARKABLE EVENTS.	SUN. Rises. H. M		SUN. Sets. H. M.		MOON. Rises. After.		MOON. Sets. Morn.	
1	S	**1st Sunday in Advent.** Klaproth	7	45	3	53	10	35	11	36
2	M	☾ 9.50 A. [b. 1743	7	46	3	52	11	45	After	
3	Tu		7	47	3	52	Morn		0	24
4	W	Galvani d. 1798. R. Kennett d. 1896	7	48	3	51	0	52	0	46
5	Th		7	50	3	51	1	58	1	7
6	F	Obernetter's Chromo-photo. pat. 1864	7	51	3	50	3	3	1	30
7	S		7	53	3	50	4	6	1	56
8	S	**2nd Sunday in Advent**	7	54	3	50	5	8	2	26
9	M	Scheele b. 1742. Duc de Luynes d.	7	55	3	50	6	7	3	1
10	Tu	[1867	7	56	3	49	7	5	3	42
11	W	Sir D. Brewster b. 1781. ● 2.53 M.	7	57	3	49	7	56	4	29
12	Th	Rev. J. B. Reade d. 1870	7	58	3	49	8	40	5	24
13	F	First Photo-enam. Proc. pat. 1854	7	59	3	49	9	20	6	25
14	S	E. Anthony d. 1888	8	0	3	49	9	53	7	30
15	S	**3rd Sunday in Advent**	8	1	3	49	10	23	8	38
16	M	H. Greenwood d. 1884. T. Ross d.	8	2	3	49	10	50	9	47
17	Tu	Sir Humphry Davy b. 1778 [1870	8	3	3	49	11	14	10	59
18	W	☽ 8.35 A.	8	3	3	50	11	37	Morn	
19	Th	Dr. H. W. Vogel d. 1898	8	4	3	50	After		0	13
20	F		8	5	3	50	0	29	1	28
21	S		8	6	3	50	0	59	2	45
22	S	**4th Sunday in Advent.** Wollaston	8	6	3	51	1	37	4	3
23	M	[d. 1828	8	7	3	51	2	23	5	20
24	Tu		8	7	3	52	3	21	6	31
25	W	**Christmas Day.** Sir I. Newton b.	8	7	3	53	4	28	7	33
26	Th	[1642. ○ 0.16 A.	8	7	3	54	5	41	8	24
27	F		8	8	3	54	6	58	9	3
28	S	J. T. Goddard d. 1866	8	8	3	55	8	13	9	37
29	S	**Sunday after Christmas**	8	8	3	56	9	26	10	4
30	M	J. H. Dallmeyer d. 1883	8	8	3	57	10	37	10	27
31	Tu	A. Braun d. 1877	8	8	3	58	11	45	10	50

THE Gella FLAT FILM CAMERA. THE 5×4 SIZE ONLY WEIGHS 4 lb. 8 oz. LOADED WITH 50 FILMS.

THE THORNTON-PICKARD NEW PATENT PLATE-HOLDER

Absolutely Lightproof to the most Sensitive Plate.

SEE PAGES 1223 to 1278

DECEMBER.

D. M.	D. W.	MEMORANDA.
1	S	
2	M	*For* Meetings of Societies, *see pp.* 603-655.
3	Tu	
4	W	
5	Th	
6	F	
7	S	
8	S	
9	M	
10	Tu	
11	W	
12	Th	
13	F	
14	S	
15	S	
16	M	
17	Tu	
18	W	
19	Th	
20	F	
21	S	
22	S	
23	M	
24	Tu	
25	W	
26	Th	
27	F	
28	S	
29	S	
30	M	
31	Tu	

THE Tella CAMERA COMPANY, Ltd.

Telegraphic Address:
'TELLURATO, LONDON.'

110
Shaftesbury Avenue,
LONDON, W.

WEIGHTS AND MEASURES.

APOTHECARIES' WEIGHT.

SOLID MEASURE.

20 Grains = 1 Scruple = 20 Grains.
3 Scruples = 1 Drachm = 60 „
8 Drachms = 1 Ounce = 480 „
12 Ounces = 1 Pound = 5760 „

FLUID.

60 Minims = 1 Fluid Drachm.
8 Drachms = 1 Ounce.
20 Ounces = 1 Pint.
8 Pints = 1 Gallon.

The above weights are those usually adopted in formulæ.

All Chemicals are usually sold by Avoirdupois Weight, in which there are 437½ grains to the ounce.

The Precious Metals, such as Silver and Gold, are sold by Troy Weight, containing 480 grains to the ounce.

FRENCH FLUID MEASURES, AND THEIR EQUIVALENTS IN ENGLISH.

[*See also other tables in this section.*]

1 Cubic Centimètre = 17 minims nearly.
3½ „ „ = 1 drachm.
28·4 „ „ = 1 ounce.
50 „ „ = 1 ounce, 6 drachms, 5 minims.
100 „ „ = 3 ounces, 4 drachms, 9 minims.
1000 „ „ or 1 litre, = to 61 cubic inches } = 35 ounces, 1 drachm, 36 minims.

The unit of French liquid measures is a cubic *centimètre.*

A cubic *centimètre* of water measures nearly 17 minims (16·896); it weighs 15·4 grains, or 1 *gramme.* A cubic *inch* of water weighs 252·5 grains.

The unit of French weights is the gramme = 15·4 grains; thus a drachm (60 grains) is nearly 4 grammes (3·88). An easy way to convert grammes into English weight is to divide the sum by 4, which gives the equivalent in drachms very nearly thus:—

Grammes. Drachms. Oz. Drachm. Grains.
100 ÷ 4 = 25 = 3 . 1 + 43

FRENCH INTO ENGLISH FLUID MEASURES.

The following table will prove to be sufficiently accurate for photographic purposes :—

1	cubic centimètre	=	17	minims (as near as possible).							
2	cubic centimètres	=	34	,,							
3	,,	=	51	,,							
4	,,	=	68	,,	or	1	drachm	8	minims.		
5	,,	=	85	,,	,,	1	,,	25	,,		
6	,,	=	102	,,	,,	1	,,	42	,,		
7	,,	=	119	,,	,,	1	,,	59	,,		
8	,,	=	136	,,	,,	2	drachms	16	,,		
9	,,	=	153	,,	,,	2	,,	33	,,		
10	,,	=	170	,,	,,	2	,,	50	,,		
20	,,	=	340	,,	,,	5	,,	40	,,		
30	,,	=	510	,,	,,	1	ounce	0	drachm	30	minims.
40	,,	=	680	,,	,,	1	,,	3	drachms	20	,,
50	,,	=	850	,,	,,	1	,,	6	,,	10	,,
60	,,	=	1020	,,	,,	2	ounces	1	,,	0	,,
70	,,	=	1190	,,	,,	2	,,	3	,,	50	,,
80	,,	=	1360	,,	,,	2	,,	6	,,	40	,,
90	,,	=	1530	,,	,,	3	,,	1	,,	30	,,
100	,,	=	1700	,,	,,	3	,,	4	,,	20	,,

FRENCH INTO ENGLISH WEIGHTS.

1	gramme	=	15⅖	grains.					
2	grammes	=	30⅘	,,					
3	,,	=	46⅕	,,					
4	,,	=	61⅗	,,	.... or	1	drachm	1⅗	grain.
5	,,	=	77	,,	.... ,,	1	,,	17	grains.
6	,,	=	92⅖	,,	.... ,,	1	,,	32⅖	,,
7	,,	=	107⅘	,,	.... ,,	1	,,	47⅘	,,
8	,,	=	123⅕	,,	.... ,,	2	drachms	3⅕	,,
9	,,	=	138⅗	,,	.... ,,	2	,,	18⅗	,,
10	,,	=	154	,	.... ,,	2	,,	34	,,
11	,,	=	169⅖	,,	.... ,,	2	,,	49⅖	,,
12	,,	=	184⅘	,,	.... ,,	3	,,	4⅘	,,
13	,,	=	200⅕	,,	.... ,,	3	,,	20⅕	,,
14	,,	=	215⅗	,,	.... ,,	3	,,	35⅗	,,
15	,,	=	231	,,	.... ,,	3	,,	51	,,
16	,,	=	246⅖	,,	.... ,,	4	,,	6⅖	,,
17	,,	=	261⅘	,,	.... ,,	4	,,	21⅘	,,
18	,,	=	277⅕	,,	.... ,,	4	,,	37⅕	,,
19	,,	=	292⅗	,,	.... ,,	4	,,	52⅗	,,
20	,,	=	308	,,	.... ,,	5	,,	8	,,
30	,,	=	462	,,	.... ,,	7	,,	42	,,
40	,,	=	616	,,	.... ,,	10	,,	16	,,
50	,,	=	770	,,	.... ,,	12	,,	50	,,
60	,,	=	924	,,	.... ,,	15	,,	24	,,
70	,,	=	1078	,,	.... ,,	17	,,	58	,,
80	,,	=	1232	,,	.... ,,	20	,,	32	,,
90	,,	=	1386	,,	.... ,,	23	,,	6	,,
100	,,	=	1540	,,	.... ,,	25	,,	40	,,

NEW METRIC WEIGHTS AND MEASURES.

[From the *Journal* of the Royal Photographic Society.]

In accordance with a resolution passed by the Council of this Society, directing the publication, in the Journal, of the Order in Council dated May 19, 1898, substituting a new table of imperial and metric equivalents for that set forth in Part I. of the Third Schedule of the Weights and Measures Act, 1878, we give below an abstract from the new Schedule of such measures of weight, length, capacity, &c., which are in common use amongst photographers in this country.

Equivalents of Metric Weights and Measures in Terms of Imperial Weights and Measures.

Linear Measure.

1 Millimetre (Mm.) (1/1000th M.) = 0·03937 Inch
1 Centimetre (1/100th M.)...... = 0·3937 ,,
1 Decimetre (1/10th M.) ...... = 3·937 Inches
1 Metre (M.)...................... = { 39·370113 Inches, 3·280843 Feet, 1·0936143 Yards.
1 Dekametre (10 M.) .... = 10·936 Yards
1 Hectometre (100 M.) .... = 109·36 ,,
Kilometre (1000 M.) .... = 0·62137 Mile

Square Measure.

1 Square Centimetre .... = 0·155 Square Inch
1 ,, Decimetre (100 Sq. Centimetres) .... = 15·5 Square Inches
1 Square Metre (100 Square Decimetres .... = { 10·7639 Square Feet, 1·196 Square Yards

Cubic Measure.

1 Cubic Centimetre............... = 0·061 Cubic Inch
1 ,, Decimetre (C.D.)(1000 Cubic Centimetres) .... = 61·024 Cubic Inches
1 Cubic Metre (1000 Cubic Decimetres) .... = { 35·3148 Cubic Feet, 1·307954 Cubic Yards

Measure of Capacity.

1 Centilitre (1/100th Litre) ... = 0·07 Gill
1 Decilitre (1/10th Litre) ...... = 0·176 Pint
1 Litre .... = 1·7598 Pints
1 Dekalitre (10 Litres) .... = 2·2 Gallons

Weight.		*Avoirdupois.*
1 Milligramme (1/1000th Grm.)	=	0 015 Grain
1 Centigramme (1/100th Grm.)	=	0·154 ,,
1 Decigramme (1/10th Grm.)	=	1·543 Grains
1 Gramme (1 Grm.)	=	15·432 ,,
1 Dekagramme (10 Grm.)	=	5·644 Drachms
1 Hectogramme (100 Grm.) ...	=	3·527 Ounces
1 Kilogramme (1000 Grm.)	=	2·2046223 lbs. or 15432·3564 Grains
1 Quintal (100 Kilog.)	=	1·968 Cwt.
		Apothecaries'.
1 Gramme (1 Grm.)	=	0·2572 Drachm 0·7716 Scruple 15·432 Grains
		Troy.
1 Gramme (1 Grm.)	=	0·03215 Ounce

Equivalents of Imperial Weights and Measures in Terms of Metric Weights and Measures.

LINEAR MEASURE.

1 Inch	=	25·4 Millimetres
1 Foot	=	0·3048 Metre
1 Yard	=	0·914399 ,,
1 Mile	=	1·6093 Kilometres

SQUARE MEASURE.

1 Square Inch	=	6·4516 Square Centimetres
1 ,, Foot	=	9·2903 ,, Decimetres
1 ,, Yard	=	0·836126 ,, Metre
1 ,, Mile	=	259·0 Hectares

CUBIC MEASURE.

1 Cubic Inch	=	16·387 Cubic Centimetres
1 ,, Foot	=	0·028317 Cubic Metre
1 ,, Yard	=	0·764553 ,, ,,

MEASURES OF CAPACITY.

1 Pint	=	0·568 Litre
1 Quart..............................	=	1·136 ,,
1 Gallon	=	4·5459631 Litres

APOTHECARIES' MEASURE.

1 Minim	=	0·059 Millilitre
1 Fluid Scruple	=	1·184 ,,
1 ,, Drachm (60 Minims)...	=	3·552 Millilitres
1 ,, Ounce (8 Drachms) ...	=	2·84123 Centilitres
1 Pint	=	0·568 Litre

AVOIRDUPOIS WEIGHT.

1 Grain .... = 0·0648 Gramme
1 Ounce.............................. = 28·350 Grammes
1 Pound...... .... = 0·45359243 Kilogramme
1 Hundredweight.................. = 50·80 Kilogrmmes.

APOTHECARIES' WEIGHT.

1 Grain .... = 0·0648 Gramme
1 Scruple (20 Grains)............ = 1·296 Grammes
1 Drachm (3 Scruples) .... = 3·888 ,,
1 Ounce (8 Drachms) .... = 31·1035 ,,

Note.—The Metre is represented by the distance marked by two fine lines on the iridio-platinum standard bar numbered 16, when at the temperature of 0° Centigrade. This bar is deposited with the Board of Trade. The metre is the only unit of metric measure of extension from which all other metric measures of extension, whether linear, superficial, or solid, shall be ascertained.

The Kilogramme is represented by the cylindrical iridio-platinum standard kilogramme weight numbered 18, which is deposited with the Board of Trade. The kilogramme is the only unit of metric weight from which all other metric weights, and all measures having reference to metric weight, shall be ascertained.

The Litre is represented by the capacity at 0° Centigrade of the cylindrical brass measure marked 'litre, 1897' (which is deposited with the Board of Trade), and having a diameter equal to one-half its height. This litre at 0° Centigrade when full contains one kilogramme of distilled water at the temperature of 4° Centigrade, under an atmospheric pressure equal to that represented by a column of mercury 760 millimetres high at 0° Centigrade at sea-level, and at latitude 45°, the weighing being made in air, but reduced by calculation to a vacuum. It is the only unit of metric measure of capacity from which all other metric measures of capacity, as well for liquids as for dry goods, shall be ascertained.

POSTAL INFORMATION.

INLAND LETTERS.

The rates for Inland Letters are as follows :—

4 ozs.	1*d.*	10 ozs.	2½*d.*	16 ozs.	4*d.*
6 ozs.	1½*d.*	12 ozs.	3*d*	18 ozs.	4½*d.*
8 ozs.	2*d.*	14 ozs.	3½*d.*	20 ozs.	5*d.*

and so on for greater weights at ½*d.* extra for every additional 2 ozs. No letter may exceed 24 in. long, 12 in. wide, or 12 in. deep. Letters posted unpaid are charged double postage on delivery ; those insufficiently paid double the deficiency.

EXPRESS DELIVERY.—Letters and parcels are accepted at most of the principal offices for express delivery, at an extra charge of 3*d.* for every mile or part. The cost of cab hire extra if required. The packet must be handed over counter at the Post Office, with postage and fee affixed in stamps, and "Express Delivery" boldly written at top left corner.

Single letters not exceeding 4 ozs. in weight can be sent by railway. The postage and a fee of 2*d.* must be paid to the railway servant receiving such letter, and he will affix and obliterate a special label. Such letters *must be* taken to a passenger station, and will be sent to destination by first available train. They may be addressed to the Parcel Office at the station of destination "to be called for," or, if so desired, will be posted in the nearest Post Office to the station to which addressed for delivery by ordinary post.

INLAND NEWSPAPERS.

The ordinary postal rate on newspapers is a halfpenny for every 2 ozs. ; but publications which consist wholly or in part of news, or articles on current topics, and which are printed and published in the United Kingdom at intervals of not more than seven days, may—for an annual fee of 5*s.*—be registered for transmission by post in the United Kingdom at the newspaper rate of a halfpenny each, irrespective of weight. The full title and date of publication must be printed at the top of first page, and the date and part or all of the title on every other page No newspaper packet may be above 5 lbs. in weight, 24 in. long, 12 in. wide, or 12 in. deep. Registered newspapers must be so folded that the title may easily be read, and must be posted either without a cover, or in one open at the ends, so as to admit of easy removal for examination. Nothing of the nature of a letter may be written on the newspaper or its cover, except a reference to any part of such paper.

NEWSPAPER WRAPPERS.—Halfpenny stamp, ¾*d.* each, 7 for 4*d.*, or 22*s.* 10*d.* per 480. Penny stamp, 1¼*d.* each ; 8 for 8½*d.*, or 21*s.* 3*d.* per 240. Sheets of halfpenny wrappers may be obtained at 2 days' notice in packets of 120 sheets of 14 wrappers each at £3 18*s.*

INLAND BOOK POST.

Except in regard to 2-ozs. packets, which may still be sent for a halfpenny, the Book Post is practically abolished, all packets over 2 ozs. being subject to the same rates and regulations as Letters (which see).

A 2-oz. Book Packet may contain any matter wholly printed on paper, or other substance in ordinary use for printing; books or literary publications, sketches, drawings, paintings, maps, plans, &c.; invoices, advice notes, bills of lading, and similar commercial and legal documents, provided that nothing is written on them of the nature of a letter, or other entries proper to such documents; proofs or manuscripts for press, and examination papers under similar conditions, and circulars or printed notices. The circular may be altered in writing, and, in the case of notices of meeting, the place, hour, date, and objects may also be inserted. (The word "printed" is intended to cover only forms produced in numbers by ordinary mechanical means; imitation type-written circulars are included if in identical terms and in numbers of not less than 20 specially handed over the counter at a Post Office and attention called to their nature.) A Book Packet may be posted either without a cover, or in one open at both ends, so as to admit of easy withdrawal for examination. The ends may be secured with string, but stamps may not be fixed partly to the wrapper, and partly on the publication.

INLAND PARCELS POST.

Parcels for conveyance within the United Kingdom can be posted at any Post Office. The limit of length allowed is 3 ft. 6 in., and the maximum of length and girth is 6 ft., *i.e.*, a Parcel 3 ft. 6 in. long may measure 2 ft. 6 in. in girth round the thickest part. The Rates of Postage, which must be prepaid, are as follows:

1 lb.	3*d.*	5 lbs.	7*d.*	9 lbs.	0*s.* 11*d.*
2 lbs....	4*d.*	6 ,, ...	8*d.*	10 ,, ...	1*s.* 0*d.*
3 ,, ...	5*d.*	7 ,, ...	9*d.*	11 ,, ...	1*s.* 0*d.*
4 ,, ...	6*d.*	8 ,, ...	10*d.*		

11 lbs. is the limit allowed.

BARNET PLATES & Papers.

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POSTAL—"ELLIOTT & SON, BARNET."

TELEPHONE—
"No. 11 BARNET."

TELEGRAMS—
"ELLIOTT, BARNET."

·1901·

SPEEDS AND QUALIFICATIONS OF BARNET PLATES

	Approximate Speeds.		
	H. & D.	Watkins.	Wynn.
Barnet "Ordinary" Plate. For Field, general purposes, and Copying, and specially recommended to beginners; it is thickly coated and allows great latitude in exposure. Used in conjunction with our Exposure Cards (one of which is enclosed with each box), wrong exposure is almost impossible.	50	64	f 64
Barnet "Medium" Plate. For Field or Studio Work. This Brand combines the advantages of good average speed, with superlative quality. We can confidently recommend it as the most perfect all-round Plate. When in doubt as to what plate to use, the Barnet Medium can be adopted with certainty of success. Formerly known as the Barnet Studio Plate.	100	128	f 90
Barnet "Extra Rapid" Plate. For Studio and Landscape, and recommended to Hand Camerists; the most popular instantaneous plate. Made always up to speed. ¼-plates accurately cut, and on thin glass.	200	256	f 128
Barnet "Rocket" Plate. The quickest plate made, and exceptionally fine in grain. It can be forced to any reasonable extent without fogging. Specially made for all classes of high speed shutter work. Thickly coated. ¼-plates accurately cut from thin crystal glass.	250	300	f 156

Barnet "Lantern" Plate.

A wide range of tones can be obtained, from black to warm red, by simple variation of exposure and development. Explicit instructions enclosed with each box.

Barnet "Photo-Mechanical" Plate.

Specially manufactured to suit the requirements of process workers in line and half tone.

NOTE.

The Hurter & Driffield, Watkins or Wynn Speed Meters can be obtained through any Dealer of standing.

IMPORTANT NOTICE. - - It is well to note that the Speed Numbers we have given indicate the actual speeds attained with the use of our "Standard Developer," as being more practical for every-day use than the Standard Ferrous Oxylate Developer used for scientific measurements. Our speed numbers may of course be doubled by using the more powerful developers.

BARNET PLATES.

Size.	PHOTO-MECHANICAL ORDINARY, EXTRA RAPID, STUDIO, AND LANTERN.	ROCKET. Black Label, Red Letters.	Additional Price for Backing.
	PER DOZ.	PER DOZ.	PER DOZ.
4¼ by 3¼	1/0	1/6	–/3
5 ,, 4	1/7	2/6	–/4
6½ ,, 4¼	2/2	3/3	–/6
6½ ,, 4¾	2/3	3/8	–/6
7¼ ,, 4½	2/10	4/6	–/6
7½ ,, 5	3/5	5/3	–/9
8½ ,, 6½	4/3	6/6	–/9
9 ,, 7	5/0	8/0	–/9
10 ,, 8	7/3	10/6	1/0
13 ,, 9	10/0	15/0	1/3
12 ,, 10	10/6	16/0	1/6
15 ,, 12	18/0	28/0	2/0
18 ,, 16	32/6	50/0	3/0
24 ,, 18	51/0	76/6	
24 ,, 20	60/0	90/0	

Other sizes made to order. 8½ × 6½ are packed in half-dozens to order at 6d. per dozen extra. 10 × 8 and upwards are packed in half-dozens without extra charge.

ELLIOTT & SON, BARNET, HERTS.

PRICE LIST OF CONTINENTAL SIZES UPON APPLICATION.

NOTICE TO LANTERNISTS.

One Make Only.
Gives Cold or Warm Tones.

THE BARNET LANTERN PLATE.

1/-
PER DOZ.

Every Box contains full instructions for working and for obtaining a wide range of tones. Those who seek further instruction in Slide Making are referred to the highest authority on the subject, Mr. ANDREW PRINGLE, in his excellent article written expressly for us in

THE BARNET BOOK OF PHOTOGRAPHY.

Price 1/- net. **Postage 4d.**

ELLIOTT & SON, BARNET, HERTS.

Barnet SNOW Enamel Paper

A Bromide Paper having highly Enamelled Surface, giving a purity of effect, and minute rendering of detail, so essential in Micrographic and other Scientific work.

PACKETS.

4¼ by 3¼	... ...	12 sheets	... ...	0/8
5 „ 4	... ...	12 „	... ...	1/0
6½ „ 4¾	... ...	12 „	... ...	1/6
7½ „ 5	... ...	12 „	... ...	1/8
8½ „ 6½	... ...	12 „	... ...	2/6
10 „ 8	... ...	12 „	... ...	3/6
12 „ 10	... ...	12 „	... ...	5/0
12½ „ 10½	... ...	12 „	... ...	5/6
15 „ 12	for 6 sheets 3/6	for 12 sheets	... ...	7/0
15½ „ 12½	„ 3/9	„	... ...	7/6
23 „ 17	„ 7/0	„	... ...	14/0
25 „ 21	„ 10/6	„	... ...	21/0
30 „ 25	„ 14/3	„	... ...	28/6
40 „ 30	„ 23/3	„	... ...	46/6

25-feet ROLLS.

12 inches wide	... ...	11/10
18 „	... ...	17/4
25 „	... ...	24/4
30 „	... ...	29/2

ELLIOTT & SON, BARNET.

PRICE LIST OF CONTINENTAL SIZES UPON APPLICATION.

BARNET

BROMIDE PAPER.

PLATINO-MATT	.. ..	**Smooth**	**UNIFORM PRICE.**
DO. do.	.. ..	**Rough**	
DO. do.	.. **Cream**	**Crayon**	
ENLARGING	.. ..	**Rough**	

	6 SHEETS.		**12 SHEETS in Packet.**	
	s. d.		s. d.	
4¼ by 3¼	—	...	0 6	... ...
5 ,, 4	—	...	0 9	... ...
6½ ,, 4¾	—	...	1 0	... ...
7½ ,, 5	—	...	1 3	... ...
8½ ,, 6½	—	...	2 0	... ...
10 ,, 8	—	...	3 0	in Tube or Packet.
12 ,, 10	2 2	...	4 2	,, ,, ,,
12½ ,, 10½	2 4	...	4 6	,, ,, ,,
15 ,, 12	3 3	...	6 3	,, ,, ,,
15½ ,, 12½	3 6	...	6 9	,, ,, ,,
18 ,, 15	5 0	...	9 6	,, ,, ,,
23 ,, 17	6 9	...	12 6	,, ,, ,,
25 ,, 21	9 6	...	18 0	,, ,, ,,
30 ,, 25	13 6	...	26 0	,, ,, ,,

ROLLS.

	s. d.
Rolls of 10 feet, 24½ inches wide	8 6
,, 25 ,, 40 ,, ,, ...	35 0
,, 25 ,, 25 ,, ,, ...	23 0
Gross Boxes of Cabinet	10 0

Rolls of any width up to 40 inches cut to order.

ELLIOTT & SON, BARNET, HERTS.

PRICE LIST OF CONTINENTAL SIZES UPON APPLICATION.

A NEW PAPER,
SPECIALLY MADE FOR

ENLARGEMENTS.

In addition to our well-known
BARNET PLATINO-MATT BROMIDE PAPERS,
we have now introduced a Bromide Paper specially
adapted for Enlargements in two grades.

BARNET . .
Bromide Paper

For Enlarging.

Rough Ordinary.

Smooth Ordinary.

Special Features:
GREAT LATITUDE IN EXPOSURE.
GREATER BRILLIANCY.
PURE WHITES.

NOTE.—When Enlarging from very hard negatives, use
BARNET PLATINO-MATT BROMIDE PAPER.

MANUFACTURED BY ELLIOTT & SON, BARNET, HERTS.

BARNET FILMS...

Specially recommended to

CYCLISTS AND TRAVELLERS,

having the advantage of being

PORTABLE, UNBREAKABLE AND ABSOLUTELY RELIABLE.

Price Per Dozen.

SIZE.	"Ordinary" and "Extra Rapid."	"Rocket."
	Per Doz.	Per Doz.
4¼ by 3¼	1/6	2/0
5 „ 4	2/6	3/0
6½ „ 4¾	3/8	4/6
8½ „ 6½	6/6	8/0
10 „ 8	10/0	12/0

ELLIOTT & SON, BARNET.

PRICE LIST OF CONTINENTAL SIZES UPON APPLICATION

Barnet P.O.P.

Mauve.
White.
Pink.

Packets	3¼ by 3¼	... ...	47 pieces	... 1/0
	3½ ,, 3½	... ...	40 ,, ...	... 1/0
	4 ,, 3	... ...	42 ,, ...	... 1/0
	4¼ ,, 3¼	... ...	36 ,, ...	... 1/0
	5 ,, 4	... ...	24 ,, ...	... 1/0
	6 ,, 4¼	... ...	24 ,, ...	... 1/0
	6½ ,, 4¾	... ...	16 ,, ...	... 1/0
	7½ ,, 5	... ...	12 ,, ...	... 1/0
	8½ ,, 6½	... ...	9 ,, ...	... 1/0
	10 ,, 8	... ...	12 ,, ...	... 2/0
	12 ,, 10	... ...	12 ,, ...	... 3/0

Tubes.	Containing 2 Sheets	...	24½ by 17	... 1/4
	,, 6 ,,	...	24½ ,, 17	... 4/0
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Farnham and District Photographic Society.—(Established 1898.)—Meetings held at the Auction Mart, South Street, Farnham. *President*—John Henry Knight. *Vice-Presidents*—Lady Rose and Charles Levy. *Secretary and Treasurer*—George A. Hale, 25 The Borough, Farnham, Surrey.

Frome Camera Club.—(Established 1897.)—Meetings are held at Frome. *President*—Dr. E. A. Child, F.R.G.S. *Vice-President*—P. E. Le Gros. *Committee*—F. H. Penny, F. C. Witham, J. A. Beynon, R. Bourne. *Secretary and Treasurer*—H. A. Gliddon, Bank House, Frome.

Fylde Amateur Photographic Society.—(Established 1895.)—Meetings held at Blower's Restaurant, South Shore, Blackpool. *President*—Dr. Vinter. *Committee*—G. H. Holmes, J. Turnbull, J. J. Fleming. *Treasurer*—L. Harrison. *Secretary*—J. Smith, 22 Dean Street, South Shore, Blackpool.

Gainsborough and District Camera Club.—(Established 1894.)—Meetings are held at 21 Beaumont Street, Gainsborough. *President*—H. C. H. Allanby. *Vice-Presidents*—F. J. Cribb, Mrs. Passmore, Miss Fouest, Rev. G. L. May. *Committee*—E. G. Pepper, W. R. Ellison, A. E. Longworth, J. W. Brocksom. *Secretary*—R. C. Puckering, Clinton House, Gainsborough.

Glasgow and West of Scotland Amateur Photographic Association.—(Established 1883.)—Meetings held at 180 West Regent Street, Glasgow. *President*—Thomas W. Robertson. *Vice-President*—George Watson, B.A. *Council*—C. Todd, T. Taylor, A. Watson, R. Garry, W. Miller, G. Chalmers, J. C. Oliver, J. N. Reoch, J. I. Fraser, A. J. Kay. *Treasurer*—William J. B. Halley. *Secretary*—William Goodwin, 3 Lynedoch Street, Glasgow.

Glasgow Camera Club.—(Established 1895.)—Meetings held at 46 Gordon Street, Glasgow. *President*—W. M. Muirhead. *Vice-Presidents*—W. Wilson and T. Davidson. *Committee*—K. McLean, D. R. McDonald, T. S. Muir, A. H. Duncan, — Young, T. Walker, J. Brough, R. Hamilton, G. Ritchie, J. R. Saunders, R. F. Hutchison, W. Ritchie, K. Hutchison. *Treasurer*—James Gray. *Secretary*—John H. A. McIntyre, M.I.M.E. 21 Victoria Gardens, Dowanhill, Glasgow.

Glasgow Photographic Association.—(Established 1862.)—Meetings held at the Philosophical Society's Rooms. *President*—John Stuart. *Vice-Presidents*—J. Craig Annan and William Lang, F.C.S.. *Council*—Robert Dodd, J. E. Hanbidge, George Mason, A. Lindsay Miller, J. C. Oliver, Archd. Watson. *Treasurer*—George Bell. *Secretary*—Charles Macdonald, 100 West Regent Street, Glasgow.

Goldsmiths' Institute Camera Club.—(Established 1893.)—Meetings held at the Goldsmiths' Institute, New Cross, London, S.E. *President*—J. W. Penfold. *Vice-Presidents*—W. J. Pope, W. G. Hodge, W. T. Wilkinson. *Committee*—Messrs. Rogers, Williams, Sidery, Smythe, Henderson, and Turner. *Treasurer*—W. Jacob. *Joint Secretaries*—A. H. Downey and C. B. Storey, The Goldsmiths' Institute, New Cross, London, S.E.

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Gloucestershire Photographic Society.—(Established 1883.)—Meetings held at the Guildhall, Gloucester. *President*—Dr. Campbell. *Vice-President*—S. G. Jones. *Committee*—H. Medland, R. W. Dugdale, A. H. Pitcher, Dr. Oscar Clark, Rev. W. T. Alstone. *Treasurer*—J. Tibbitts. *Secretary*—Edward A. Ind, 36 Northgate, Gloucester.

Gospel Oak Photographic Society.—(Established 1894.)—Meetings held at the Congregational Schools, Lismore Road, Gospel Oak, N.W. *President*—Rev. H. Le Pla. *Vice-President*—F. H. Hall. *Committee*—W. Beyer, H. Date, W. J. Gorton, T. Pickard, C. Stone. *Treasurer*—J. E. Rayner. *Secretary*—Henry Billingsley, 6 Burghley Road, Kentish Town, N.W. *Assistant Secretary*—W. Kilbey.

Graphic Society.—(Established 1885.)—*President*—S. Kerswell. *Council*—The Officers, Miss Stoyle, Mrs. Allen, Messrs. Micklewood and Treleaven. *Treasurer*—G. F. Watson. *Secretary*—J. S. Hawker, Mutley House, Plymouth.

Gravesend Photographic Society.—Meetings are held at the Medical Hall, Milton Road, Gravesend. *President*—J. C. Johnson. *Vice-President*—E. J. Wall. *Council*—Percy J. Boorman, Horatio Sandford, B. L. Rankin, F. H. Wells, Thomas Nettleingham, S. R. Macartney, G. W. Cobham. *Secretary and Treasurer*—T. L. Winnett, 5 The Grove, Gravesend.

Greenock Camera Club.—(Established 1888.)—Meetings held at 12 Princes Street, Greenock. *President*—George Dunlop, B.L. *Vice-President*—G. T. Poulter. *Council*—M. Blake, D. Colquhoun, T. A. Cunningham, John C. Fisher, Frank Macdonald, A. Bathgate, R. Tough, jun., A. McVicar, Mrs. Fleming, Miss McCallum. *Lanternist*—R. W. Jamieson. *Treasurer*—William Morrison. *Secretary*—William D. Boyd, 37 Hamilton Street, Greenock.

Grimsby and District Photographic Society.—(Established 1894.)—Meetings held at Victoria Street, Grimsby. *President*—J. Sutcliffe, J.P. *Vice-Presidents*—R. C. Long and W. B. Simpson, M.B. *Committee*—W. C. Butler, W. J. Brumpton, H. Dodds, J. H. Clayton, W. Daddy, A. L. Kershaw, A. T. Flint, J. Wharton, G. E. Collins, C. Dewing. *Librarian*—D. Fountain. *Treasurer*—Dr. A. Westlake. *Secretary*—A. E. Matthews, 59 Ainslie Street, Grimsby.

Guildford Photographic Society.—(Established 1890.)—Meetings held at the County and Borough Halls, Guildford. *President*—The Right Hon. the Earl of Onslow, G.C.M.G. *Vice-Presidents*—G. J. Jacobs, F.R.A.S., J. Russell, R. W. Robinson, G. C. Williamson, D.Lit. *Committee*—A. W. Bullen, T. L. Inman, H. M. Moon, H. T. Munday, W. T. Patrick, H. C. Reid. *Treasurer*—J. H. Nunn. *Secretary*—A. E. Moon, 36 High Street, Guildford.

Halifax Camera Club.—(Reorganized 1895.)—Meetings held at the Studio, 29 Northgate, Halifax. *President*—J. Ingham Learoyd. *Vice-Presidents*—J. W. Holland, G. H. Hodgson, T. Illingworth, H. Mortimer, J. W. Pilling, A. Priestley, C. Thomas, C. Rhodes, G. R. Ryley. *Committee*—E. Crowther, C. Foster, E. Knapton, E. Laughton, R. Stock, J. H. Hanson, F. A. Moore. *Secretary and Treasurer*—Lionel Dickinson, 3 Livingstone Street, Lee Mount, Halifax.

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Hackney Photographic Society.—(ESTABLISHED 1889.)—Meetings held at the Pembury Hotel, Amhurst Road, Hackney. *President*—A. Horsley Hinton. *Committee*—E. Farmer, W. F. Fenton-Jones, C. T. Fleetwood, F. W. Gosling, E. Puttock, W. Rawlings, L. S. Wilks, J. J. Westcott, A. D. Fort (Assistant Secretary). *Curator*—W. A. Ellington. *Lanternist*—H. W. Dunkley. *Treasurer*—W. L. Barker. *Secretary*—Walter Selfe, 70 Paragon Road, Hackney, N.E. *Excursion Secretary*—S. C. Shean.

Haltwhistle and District Photographic Society.—(ESTABLISHED 1889.)—Meetings are held at Haltwhistle. *President*—Dr. W. R. Speirs. *Vice-President*—Major Anne. *Secretary and Treasurer*—David Macadam, London City and District Bank, Haltwhistle.

Hand Camera Portfolio Club.—(ESTABLISHED 1898.)—A Postal Club devoted to Hand Camera work. *President*—Surgeon-Major J. Adcock, M.D. *Secretary and Treasurer*—P. E. Bradshaw, 12 Victoria Parade, Ramsgate.

Hand Camera Postal Club.—(ESTABLISHED 1897.)—Advanced workers are eligible for membership. All applications should be accompanied by specimen prints. *Secretary and Treasurer*—George V. Myatt, Mount Pleasant House, Leek, Staffordshire.

Handsworth Photographic Society.—(ESTABLISHED 1894.)—Meetings held at College House, Hamstead Road, Handsworth, Staffordshire. *President*—Philip Whitehouse. *Vice-Presidents*—W. J. Foster, L.R.C.P., E. F. Freeland, W. J. Morgan, C. L. Stait. *Council*—G. Allen, W. Bore, J. H. Brindley, F. Greenway, H. C. Manton, E. Marlow, G. Owen, C. Proctor. *Treasurer*—C. F. Jarvis. *Secretary*—A. E. Teague, 51 Linwood Road, Handsworth, Staffordshire.

Harrogate Field, Naturalist, and Camera Club.—(ESTABLISHED 1892.)—Meetings held at the Club Rooms, James Street, Harrogate. *President*—Dr. Gaddes, L.D.S. (Eng. and Edin.). *Treasurer*—Alexander Maclean. *Photographic Secretary*—

Hastings and St. Leonards Photographic Society.—(ESTABLISHED 1888.)—*Past Presidents*—Wilson Noble and the Rev. A. B. Cotton. *President*—G. G. Gray, J.P., LL.D., F.R.G.S., F.R.H.S., F.L.S., &c. *Vice-Presidents*—Lord Brassey, K.C.B., His Worship the Mayor (Alderman F. Tuppenney, J.P.), J. H. Blomfield, A. Brooker, Dr. Locke, Rev. A. M. Macdona, Lucas Shadwell, M.P., W. Shuter, W. Stubbs, J.P., Macer Wright, J.P. *Council*—A. Brooker, W. G. Davie, R. White Ford, G. G. Gray, J. F. Mastin, W. M. Simpson, J. Smith, F. Tuppenney. *Hon. Treasurer*—W. M. Simpson. *Hon. Secretary*—A. Brooker, 21A Wellington Place, Hastings.

Helios Postal Photographic Club.—(ESTABLISHED 1887.) A Postal Photographic Club, circulating portfolios amongst the members for the insertion of photographs, which are mutually criticised upon forms supplied for the purpose. *Secretary and Treasurer*—Henry Everett, F.I.S., 55 Locksley Street, Burdett Road, London, E.

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Herefordshire Photographic Society.—(Established 1885.)—Meetings held at Clarence House, West Street, Hereford. *President*—Alderman T. Blake, J.P. *Vice-Presidents*—A. Watkins, T. J. Salwey, J. Parker, W. J. Humfrys, H. H. Parry. *Council*—A. C. Slatter, A. C. Edwards, W. Groom, E. H. Matthews, E. Horth, W. Roberts. *Treasurer*—W. E. Haines. *Secretary*—Cecil Gethen, 9 St. Nicholas Street, Hereford.

Highbury Quadrant Scientific and Photographic Society.—Meetings held at the Large Vestry. *President*—Rev. J. W. Dawson. *Vice-Preidents*—Miss Isabel A. Newton, B.A., J. W. Brigstock, William Cook, H. W. Nettleship. *Committee*—Miss Kate Hands, Miss C. Rumney, A. S. Ansley, J. H. Bolton, R H. Glassock, A. Hewitt, R. K. Munro. *Hon. Treasurer*—E. W. Brigstock. *Hon. Secretary*—A. E. Birch, 24 Grayling Road, N. *Hon. Secretaries*—Electrical Section: G. C. Saw, 58 Brownswood Road, N.; Field Club: Miss C. R. Emery, 100 Wilberforce Road, N.; Microscopical Section: C. A. Weller, 182 Highbury New Park, N.

Holmfirth Amateur Photographic Society.—(Established 1885.)—*President*—Arthur Preston. *Secretary and Treasurer*—David Bilson, Birchin House, Holmfirth.

Hove Camera Club.—(Established 1891.)—Meetings and Annual Exhibition held at the Town Hall, Hove. *President*—Alderman G. B. Woodruff, J.P. *Vice-Presidents*—Charles Job, E. E. Mainwaring, W. H. Honnsom. *Committee*—Messrs. Sargeant, Foskett, Ford, Gadsby, and Gilkes. *Secretary and Treasurer*—C. Berrington Stoner, 24 Holland Road, Hove.

Huddersfield Naturalist and Photographic Society.—(Established 1849.)—Meetings held at the Y.M.C.A. Rooms, King Street, Huddersfield. *President*—W. A. Beevers. *Vice-Presidents*—T. W. Woodhead and H. G. Brierley. *Committee*—A. Houghton, T. H. Bartlam, J. B. Littlewood, F. Netherwood, Thomas Kendal, G. R. Cartmell, Thomas Jenkinson, Mrs. H. G. Brierley. *Treasurer*—A. W. Whiteley. *Secretary*—Mr. Tompers, L.D.S.Eng., Wood Street, Longwood, Huddersfield.

Hull Photographic Society.—(Established 1884.)—Meetings are held at 71 Prospect Street, Hull. *President*—F. Atkinson. *Vice-Presidents*—J. Hollingworth, M.R.C.S., and F. Woollons. *Council*—W. Alton, F. Atkinson, J. W. Atkinson, W. Dalton, W. Gilleard, T. J. Hards, E. A. Hellier, J. Hollingworth, M R.C.S., Major R. E. Johnson, W. M. Lyth, H. Pybus, J. Pybus, T. J. Scott, A. H. Spaven, J. W. Williams, F. Woollons. *Treasurer*—T. J. Scott. *Secretary*—J. W. Atkinson, 5 Park Road, Hull.

Hyde Amateur Photographic Society.—(Established 1898.)—Meetings are held at 4 Reynard Street. *President*—Councillor Pollard, J.P. *Vice-President*—Rev. H. E. Dowson. *Committee*—P. Marshall, J. Boote, T. Rogers, J. Knott, T. Hadfield, G. Hibbert, and Messrs. Johnson and Smith. *Treasurer*—R. Swindells. *Hon. Secretary*—Ainslie Cook, 16 Great Norbury Street, Hyde.

Idlers' Camera Club, Bristol.—*President*—Charles Harry. *Hon. Secretary*—A. F. V. Collett, 52 Belmont Road, Montpelier, Bristol.

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Ipswich Scientific Society (Photographic Section).—(Established 1860.)—Meetings are held at the Museum, Ipswich, on first Wednesday in the month *President*—E. P. Ridley, F.G.S. *Secretary*—Frank Woolnough, Museum, Ipswich.

Isle of Thanet Photographic Society.—(Established 1888.)—Affiliated to the Royal Photographic Society. *President*—Rev. Canon H. Bartram, M.A. *Vice-Presidents*—Rev. C. E. Eastgate, J. H. Forwalk, G. F. Blower, Rev. G. Remfry Brookes, Dr. Arthur Rowe, Dr. Griffiths. *Committee*—E. Deacon, H. G. Holloway, G. E. Hoile, J. Savage, P. Solly, A. Vigar. *Hon. Lanternist*—J. H. Forwalk. *Assistant Lanternist*—E. Deacon. *Hon. Librarian*—B. Barnett. *Delegate to the Royal Photographic Society*—J. C. Goldsack. *Hon. Secretary and Treasurer*—J. C. Goldsack, Llanberis, Grove Road, Ramsgate.

Keighley and District Photographic Association.—(Established 1889.)—Meetings are held at the Mechanics' Institute, Keighley. *President*—Thomas Heap. *Vice-Presidents*—S. Bairstow, J. G. Dickenson, J. Gill, Alexander Keighley, E. Myers. *Committee*—J. H. Bentley, M. Houghton, E. F. Lever, G. H. Naylor, B. P. Heaton, T. A. Smith, Taylor Smith, W. Tate. *Treasurer*—Walter Mitchell. *Secretaries*—C. H. Smith, 110 Devonshire Street, Keighley, and W. H. Hainsworth, Cononley, near Keighley.

Kent Postal Camera Club.—(Established 1894.)—A circulating monthly portfolio. *Secretary*—Ernest W. Hawes, Nizels, Chislehurst.

Kilmarnock and Ayrshire Photographic Society.—(Established 1887.)—Meetings held at Kilmarnock. *President*—Robert Boyd. *Vice-President*—J. J. Railton. *Council*—Robert Boyd, J. J. Railton, John Henderson, Thomas Ferguson, Robert Gudgeon, Thomas H. Milloy. *Treasurer*—John Henderson. *Secretary*—Thomas H. Milloy, 15 William Street, Kilmarnock.

King's Lynn Photographic Society.—(Established 1893.)—*President*—S. A. Gurney. *Council*—Messrs. Bridges, Cockle, Crisp, Taylor, Winch, and Officers. *Treasurer*—H. Tilson. *Secretary*—W. E. Daw, Church Street, King's Lynn.

Kingston-on-Thames and District Photographic Society.—(Established 1893.)—Meetings held at the Sun Hotel, Kingston-on Thames. *President*—Rev. G. I. Swinnerton, M.A. *Vice-Presidents*—W. M. Robertson, Dr. Munyard, Dr. Finny, W. E. Price, A.M.I.C.E., George Sanders, J.P., Dr. Luscombe. *Committee*—T. W. Wilson, W. F. J. Hodgson, Albert Hill, A. Vandendriesche, H. M. C. Sprunt. *Treasurer*—W. M. Robertson. *Secretaries*—John F. East, Uxbridge House, Kingston-on-Thames, and A. E. Smith, 6 Beaufort Villas, Beaufort Road, Kingston-on-Thames.

Kirkcaldy Photographic Society.—Meetings held at the Rooms, 196 High Street. *Hon. President*—William M. Dow. *President*—David Landale. *Vice-President*—A. Harley. *Council*—Hope P. Thomson, James M. Young, William Cruickshank, George Pringle, Alexander Purves, A. B. Young. *Treasurer*—Charles Stewart. *Secretary*—S. Stewart, 2 Salisbury Street, Kirkcaldy.

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Lancashire and Yorkshire Railway Superintendent's Staff Photographic Society.—(ESTABLISHED 1900.)—Meetings held at Victoria Station, Manchester. *President*—Herbert Cottrill. *Committee*—H. Budworth, C. G. Lord, J. Seddon, W. Titley. *Secretary and Treasurer*—G. Howard, 73 Middleton Road, Heywood.

Lancaster Photographic Society.—(ESTABLISHED 1889.)—Headquarters, Stonewell, Lancaster. *President*—Alan Garnet. *Vice Presidents*—R. W. Wearing, A. S. Barling. *Committee*—J. B. Briggs, W. Clough, N. Holden, J. W. Pickard, W. Sumner, S. Thompson. *Hon. Treasurer*—J. T. Miller. *Hon. Secretary*—W. Briggs *Assistant Hon. Secretary and Librarian*—R. T. Simpson, 21 Cheapside, Lancaster.

Lantern Slide Exchange Club.—(ESTABLISHED 1889.)—Circulations and distributions per Parcel Post. *Secretary and Treasurer*—J. S. Hawker, Mutley House, Plymouth.

Leamington Amateur Photographic Society.—(ESTABLISHED 1887.)—Meetings held at the Pump Room, Leamington. *President*—Rev. Edward Healy. *Treasurer*—B. Magrath. *Secretary*—Signor Aspa, Priory House, Leamington.

Leeds Camera Club.—*President*—F. Rust. *Vice-Presidents*—J. C. Birch, A. Homburg, Major Norwood. *Hon. Members*—A. Horsley Hinton, W. Thomas, R. Child Bayley, W. E. Tindall, R.B.A. *Committee*—A. C. Allanson, G. Dixon, W. Emmott, P. Elliff, I. Howe, F. G. Issott, C. H. Pounder, E. Wainwright. *Lanternist*—H. Stockwell. *Hon. Treasurer*—J. Skilbeck. *Hon. Secretary*—F. G. Issott, 62 Compton Road.

Leeds Photographic Society.—(ESTABLISHED 1852.)—Meetings held at the Philosophical Hall, Leeds. *President*—Godfrey Bingley. *Vice-Presidents*—B. A. Burrell, F.I.C., and R. Stockdale, M.A. *Committee*—A. W. Atkinson, A. C. Beilby, F. G. Harmer, R. Mackay, A. Nicholson, J. Taylor, J. Woof. *Treasurer*—Thomas Carter. *Secretary*—J. Croisdale Coultas, Chapel Lane, Headingley.

Leicester and Leicestershire Photographic Society.—(ESTABLISHED 1885.)—Meetings are held at the Sunday-school Memorial Hall, Leicester. *President*—Joseph Toone. *Vice-President*—Thomas Brown. *Committee*—George Bankart, W. Bush, E. B. Miles, R. W. Harvey. *Treasurer*—Lewis Ough. *Secretary*—W. Murray, 185 Melton Road, Leicester.

Leigh Photographic Society.—(ESTABLISHED 1892.)—Meetings are held at the Society's Rooms, Market Place, Leigh. *President*—Dr. H. S. Hall. *Vice-Presidents*—W. Hampson, R. Leigh, J. Jones, M.B., Ch.B., R. B. Mawson, T. Lee Syms. *Committee*—C. Bruce, J. Berry, W. R. Moore, A. Preston, A. Sims, P. Seddon, J. Smith. *Hon. Treasurer*—T. Haddock. *Hon. Secretary*—T. Mercer, 2 Clarence Street, Leigh.

Leith Amateur Photographic Association.—(ESTABLISHED 1888.)—Meetings held at 16 Primrose Street, last Tuesday of each month. *Hon. President*—R. Hunter. *President*—A. C. Burge. *Vice-President*—W. Seatter. *Council*—Wilson, Guthrie, Horne. *Auditors*—Gibson and Smith. *Treasurer*—Murdoch Campbell. *Secretary*—William Duncan, Solicitor, 36 Charlotte Street, Leith.

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Light and Truth Postal Photographic Club.—(ESTABLISHED 1890.)—*Secretary*—George Harry Haycox, Arden Villa, St. Dunstan's Crescent, Worcester.

Lincolnshire Science Society.—(ESTABLISHED 1897.)—Meetings held at the Science and Art Schools, Lincoln. *President*—George M. Lowe, M.D. *Vice-Presidents*—A. E. Collis, M.I.M.E., R. C. Hallowes, A. S. Lester-Melville, Rev. E. Nelson, M.A. *Council*—President, Vice-President, Secretary, Treasurer, and Rev. J. E. Kent, J. W. Horton, W. Le Tall, W. S. Richardson, D. J. G. Watkins, M.B. *Treasurer*—C. W. Witted, *Secretary*—J. Eardley Mason, 34 Chaplin Street, Lincoln.

Liverpool Amateur Photographic Association.—(ESTABLISHED 1863.)—Meetings held at Percy Buildings, Eberle Street, Liverpool. *President*—John H. Welch. *Vice-Presidents*—Dr. Llewellyn Morgan and E. Rimbault Dibdin. *Council*—James Parkinson, F. Anyon, Dr. J. W. Ellis, F.E.S., F. K. Glazebrook, William Harvey, G. B. Newton, Joseph Earp, W. Prior Christian, E. Simnett, C. F. Depree, Paul Lange, Joseph Appleby, T. F. Lloyd, W. A. Taylor, T. E. Corney Wilson. *Treasurer*—P. H. Phillips. *Secretary*—Frederick A. Schierwater, 60 Castle Street, Liverpool.

Liverpool Central Y.M.C.A. Camera Club.—(ESTABLISHED 1880.)—Meetings held are at Mount Pleasant, Liverpool. *President*—Richard Brown. *Committee*—A. Bryning, George Coleburn, F. O. Cresswell, J. M. Dow, J. Henderson, F. Moreland. *Hon. Secretary and Treasurer*—R. A. Croston, 44 Osborne Road, Tuebrook, Liverpool.

Liverpool University College Chemical Society.—(ESTABLISHED 1893.)—*President*—W. A. Whitton. *Committee*—E. Garratt, J. F. Spencer, J. C. McConnan, A. Morton. *Secretary*—E. Briggs.

Llandudno Camera Club and Lantern Society.—(ESTABLISHED 1892.)—*President*—Lord Mostyn. *Treasurer*—W. Williams. *Secretary*—A. Ernest Deacon, Gloddaeth Street, Llandudno.

London and Provincial Photographic Association.—(ESTABLISHED 1882.)—Meetings held at the White Swan Hotel, Tudor Street, Whitefriars, E.C. *Trustees*—A. Haddon and J. B. B. Wellington. *Committee*—R. Beckett, R. P. Drage, T. E. Freshwater, J. W. Hodges, J. E. Hodd, A. Mackie, H. C. Rapson, J. S. Teape. *Curator and Lanternist*—S. Heskins. *Recorder*—E. Featherstone. *Librarian*—E. T. Wright. *Secretary and Treasurer*—Walter D. Welford, Warwick Lodge, 166 Romford Road, London, E.

Longton and District Photographic Society.—(ESTABLISHED 1894.)—Meetings are held at the Sutherland Institute. *President*—Dr. A. Parkes, L.R.C.P., M.R.C.S. *Vice-Presidents*—E. Hallam, W. T. Lucas, E. Haigh, M.A., B.Sc., &c. *Committee*—W. Bates, J. Bold, S. Jackson, G. V. Myatt, A. W. Allin, J. T. Mountford, C. S. Meigh. *Treasurer*—S. Ashcroft. *Secretary*—T. Mottershead, 43 Stafford Street, Longton, Staffordshire.

Loughborough Amateur Photographic Society.—(ESTABLISHED 1888.)—Meetings are held at Devonshire Square. *President*—Alderman W. C. Burder, J.P. *Secretaries*—P. W. Crane, 105 Toothill Road, Loughborough; and William Clarke.

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Louth and District Photographic Society.—(ESTABLISHED 1890.)—Meetings held at 8 Upgate, Louth, Lincolnshire. *President*—Rev. J. Edward Standen, M.A. *Vice-President*—F. J. Ingoldby. *Committee*—S. F. Clarke, O. Burditt, W. Shephard, A. Ingoldby, G. Godsmark, A. Plaskitt. *Treasurer*—H. S. Forman. *Secretary* (*acting*)—Rev. J. Edward Standen, M.A., 4 South Street, Louth, Lincolnshire.

Ludlow Photographic Society.—(ESTABLISHED 1897.)—Meetings are held at Butter Cross, Ludlow. *President*—Willoughby Hurt Sitwell *Vice-Presidents*—Lord Inchiquin, Edward Wood, C. A. Rouse Boughton Knight, W. St. A. Rouse Boughton, Sir C. H. Rouse Boughton, Bart., A. J. Rouse Boughton Knight. *Committee*—Tilsley Price, J. H. Suttle, W. H. Bessell, G. E. Davis, J. H. Williams. *Treasurer*—George E. Davis. *Secretary*—Tilsley Price, Gravel Hill, Ludlow.

Luton Camera Club.—(ESTABLISHED 1898).—Meetings held at Headquarters, 72 George Street, Luton. *President*—H. E. Cocker, M.P.S. *Vice-Presidents*—W. Dandy and J. Bond. *Council*—The Officers, W. J. Cooke, W. J. R. Eads, T. Cheeseman. *Hon. Treasurer*—J. H. Bailey. *Hon. Secretary*—E. J. Bradley, 4 Collingdon Street, Luton. *Assistant Secretary*—W. T. Day.

Lyonsdown Amateur Photographic Association.—(ESTABLISHED 1886.)—Meetings are held at members' houses on the last Wednesday in each month. *Treasurer*—Walter Crosbie. *Secretary*—C. B. R. Koch, Lyndhurst, King Edward Road, New Barnet, Herts.

Manchester Amateur Photographic Society.—(ESTABLISHED 1885.)—Monthly meetings held at the Manchester Athenæum. Society's Rooms, 15 Brazennose Street. *President*—J. W. Wade. *Vice-Presidents*—S. L. Coulthurst, Rev. H. W. Dick, G. E. Mellor, G. H. B. Wheeler. *General Committee*—W. M. Blackshaw, W. H. Bowman, H. B. Bradley, F. W. Burton, T. Glazebrook, P. Hancock, A. Handford, J. C. Hope, J. W. Price, L. Scholes, James Shaw, J. Wood Smith, J. W. Young. *Sub-Committees*—Record: W. H. Bowman, Rev. H. W. Dick, G. E. Mellor, J. Wood Smith, J. C. Hope (Hon. Secretary); Demonstrations and Rooms: W. M. Blackshaw, S. L. Coulthurst, A. Handford, George H. B. Wheeler, James Shaw (Hon. Secretary); Lantern: P. Hancock, A. Handford, J. W. Price, L. Scholes, F. W Burton (Hon. Secretary); Postal Club: W. M. Blackshaw, J. C. Hope, H. B. Bradley (Hon. Secretary). The President and Secretary are *ex officio* members of all Sub-Committees. *Librarian*—J. W. Young. *Editor of Magazine*—J. Wood Smith. *Hon. Treasurer*—Charles Dawson. *Secretary*—F. W. Parrott, 3 Elm Road, Altrincham.

Manchester Camera Club.—(ESTABLISHED 1883.)—*Committee*—W. A. Hepburn, F. T. Overmann, J. W. Wade. *Treasurer*—J. Davenport. *Secretary*—C. Dawson, 10 Chepstow Street, Manchester.

Manchester Photographic Society.—(ESTABLISHED 1855.)—Meetings held at the Chamber of Commerce Rooms, 44 Mosley Street, Manchester. *President*—Abel Heywood. *Vice-Presidents*—W. B. Wood and J. Whittaker. *Council*—B. J. Beckton, J. G. Chapman, W. Galloway, W. Hughes, W. Rivers, W. E. Wood. *Treasurer*—W. G. Coote. *Secretary*—C. H. Coote, 10 Holmefield, Sale, near Manchester.

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Manchester Y.M.C.A. Photographic Club.—(Established 1890.)—Meetings held at the Y.M.C.A. Buildings, 56 Peter Street, Manchester. *President*—A. C. Harrison. *Vice-Presidents*—George T. White, W. H. Machin, W. H. Cheetham. *Committee*—J. D. Birchall, L. Wormald, William Robinson, W. Crompton, A. W. Pearson, Charles Allen, A. T. Howarth, B. Bailey. *Treasurer*—George Dixon. *Secretary*—John W. Price, 56 Peter Street, Manchester.

Mansfield and District Amateur Photographic Club.—*President*—Alderman Patterson. *Committee*—Miss Jackson, Messrs. Buxton, Bradwell, Crawley, L. Meggitt, and Walkerdine. *Lanternist*—J. A. Pegg. *Treasurer*—H. Alcock. *Hon. Secretary*—Alfred Adlington, Westfield Lane, Mansfield.

Margate Cycling and Camera Club.—(Established 1892.)—Meetings held at the Britannia Hotel. *President*—George Cousins. *Treasurer*—Alfred Henry Markey. *Secretary*—Arthur Hobday, Flint House, Trinity Square, Margate.

Mid-Cheshire Society of Art.—(Established 1895.)—Meetings are held at the Society's Rooms, Castle, Northwich. *President*—Thomas Arthur Johnson. *Committee*—George B. Cliff, J.P., J. Hardie, H. J. Reid, E. P. Ward, H. Yeomans. *Treasurer*—George Holland. *Secretaries*—George Holland, 125 Chester Road, Northwich; Alfred R. E. Lewty, Castle, Northwich.

Midland Camera Club.—(Established 1891.)—*President*—H. R. Leech, M.D., M.R.C.S., J.P. *Vice-Presidents*—Hall-Edwards, L.R.C.P., Councillor Lancaster, C. Jevons Fowler. *Council*—T. H. Cox, C. J. Perry, William Dudley, M.R.C.S., T. Smallwood, J. Donaghue. *Treasurer*—R. J. Bailey. *Secretary*—H. Cooper, 19 Bearwood Road, Smethwick, Birmingham.

Midlothian Camera Club.—(Established 1889.)—*Hon. President*—Councillor Malcolm Smith. *President*—Dr. W. Stewart. *Vice-President*—Archibald Wilson. *Treasurer*—R. C. Ewart. *Secretary*—Thomas Wilson, 69 Trafalgar Lane, Leith.

Monklands Photographic Society.—(Established 1893.)—Meetings held at the Club House, Victoria Place, Airdrie. *President*—William B. Hossack. *Vice-President*—Thomas A. Macfarlane. *Committee*—Thomas A. Deas, J. D. Russell, William Baird, J. Hugginson, J. W. Eadie. *Treasurer*—James S. Lewis. *Secretary*—William Dixon Gray, Stanfield Airdrie.

National Photographic Record Association.—(Established 1897.)—Meetings held at 66 Russell Square and the Camera Club. *President*—Sir J. Benjamin Stone, M.P. *Council*—Right Hon. the Earl of Crawford, K.T., Right Hon. the Earl of Rosse, K.P., F.R.S., Sir E. Maunde Thompson, K.C.B., D.C.L., Sir H. T. Woods, M.A., Sir William de W. Abney, C.B., F.R.S., Harold Baker, Lyonel Clark, E. C. Fagan, L. Fletcher, F.R.S., St. John Hope, F.S.A., B. E. Lawrence, LL.D., E. C. Middleton, G. A. T. Middleton, Dr. H. R. Mill, R. Nevill, P. Norman, F.S.A., G. Patrick, J. Thomson, W. W. Watts, Snowden Ward. *Treasurer*—A. Graham. *Hon. Secretary*—George Scamell, 21 Avenue Road, Highgate, London, N; [illegible]

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Nantwich Camera Club.—(ESTABLISHED 1899.)—Meetings held in the Club Room, 97 Welch Row. *President*—George Crossley. *Vice-President*—C. Kitchen. *Committee*—W. Lloyd, P. Macgowan, B. Arthan. *Secretary and Treasurer*—P. Rawson, 97 Welch Row, Nantwich.

Newcastle-upon-Tyne and Northern Counties' Photographic Association.—(ESTABLISHED 1881.)—Meetings held at the Y.M.C.A. Rooms, Blackett Street, Newcastle-on-Tyne. *President*—G. B. Bainbridge. *Vice-Presidents*—J. S. B. Bell, T. M. Clague, W. S. Corder, J. P. Gibson. *Council*—C. E. Barkas, Parker Brewis, W. E. Cowan, G. Elphick, A. B. Gardiner, F. Park, W. Parry, G. L. Snowball, W. Thompson, Dr. Blacklock. *Lanternists*—J. J. Kirkwood and Edgar G. Lee. *Treasurer*—James Baty. *Secretary*—Godfrey Hastings, Station Road, Whitley Bay. *Assistant Secretary*—Mr. T. Bulman.

Newton Heath Camera Club.—(ESTABLISHED 1894.)—Meetings held at the Newton Heath Wesleyan School. *President*—W. J. Cresswell. *Vice-Presidents*—W. T. Evans and W. Knowles. *Committee*—C. Hornby, C. P. Senior, S. Smith, J. Bebbington, A. Shorples, J. Smith. *Treasurer*—J. Fortune. *Secretary*—J. Taylor, 103 Lightbourne Road, Moston, Manchester.

Northampton Natural History and Field Club (Photographic Section).—(ESTABLISHED 1882.)—Meetings are held at 1A Sheep Street, Northampton. *President* — H. Manfield. *Secretary* — C. H. Dorman, A.R.I.B.A. 51 Abington Street, Northampton.

North Lindsey Camera Club.—(ESTABLISHED 1899.)—Meetings held at Mr. Cobban's Office, Home Street, Scunthorpe. *President*—James Henderson. *Vice-Presidents*—Dr. Behrendt, A. Crooke, J. W. Hanby, A. M. Mylne. *Committee*—H. Fletcher, D. Munro, H. B. Marquand, A. M. Cobban, A. Veitch. *Lanternist*—J. Fletcher, J.P. *Librarian*—J. Behrendt. *Treasurer*—J. W. Hanby. *Secretary*—W. J. Brooke, 69 Frodingham Road, Scunthorpe, Doncaster.

North Middlesex Photographic Society.—(ESTABLISHED 1889.)—Meetings held at Jubilee House, Hornsey Road, N. *President*—R. Child Bayley. *Vice-Presidents*—H. W. Bennett and F. W. Cox. *Council*—J. J. Armitage, S. Barnard, S. Herbert Fry, E. W. Hickox, A. G. Lawson, J. W. Marchant, J. C. S. Mummery, F. L. Pither, R. R. Rawkins, C. R. Steele, W. Taylor. *Treasurer*—H. Smith. *Secretary*—H. Stuart, 40 Lambton Road, Hornsey Road, N.

Nottingham Mechanics' Institute Camera Club.—(ESTABLISHED 1892.)—Meetings held at the Mechanics' Institute. *President*—His Grace the Duke of Newcastle. *Vice-Presidents* — Lord Henry Bentinck, M.P., Colonel Sir Charles Seely, Bart., W. J. Abel, B.A., S. Bourne, J.P., A. Brown, M.I.C.E., F. N. Ellis, A. Pyatt, G. H. Wallis, F.S.A., C. B. Wright, J. Harrison. *Committee*—A. W. Flowerdew (Chairman), T. Wright, T. K. Gordon, J. Anderson, A. Black, Rev. W. H. Kynaston, M.A., A. R. Hartley, W. R. Anderson. *Albums Secretary*—L. Allen. *Hon. Secretary and Treasurer*—W. Ward, 14 Stratford Terrace, Nottingham.

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Oldham Photographic Society.—(ESTABLISHED 1867.)—Meetings held at the Oldham Lyceum, Union Street, Oldham. *President*—John Chadwick. *Vice-President*—James Hall. *Committee* - James Brooks, Travis Burton, John W. Cooper, S. Ashton, J. A. Newton, William Schofield, William Taylor, J. T. Whitehead. *Treasurer*—James Whitehead. *Secretary*—Thomas Widdop, 17 Queen Street, Oldham.

Oxford Camera Club.—(ESTABLISHED 1894.)—Meetings held at the University Museum. *President*—Sir W. J. Herschel, Bart. *Vice-Presidents*—Miss Acland, Colonel Impey, Miss Venables, C. Rippon. *Committee*—E. A. Bevers, E. C. H. Jessop, H. T. Leach, Dr. Mann, Rev. W. W. Merry, A. Robinson, G. Shelton. *Treasurer*—R. A. R Bennett. *Secretary*—George W. Norton, 13 Park Terrace, Oxford.

Paisley Philosophical Institution (Photographic Section).—(ESTABLISHED 1857.)—Meetings are held at 28 Oakshaw Street, Paisley. *President*—Rev. John Crouch. *Vice-President*—Thomas Reid, jun. *Council*—The Officers and Thomas Rastall, Robert Ferrier, James Arthur, John S. Bryce, H. A. Tulloch, Robert Easton, William Hutchison. *Treasurer*—Andrew Morris. *Secretary*—Robert Milne, 94 High Street, Paisley.

Peterborough Photographic Society.—(ESTABLISHED 1887.)—Meetings held at the Bedford Temperance Hotel. *President*—G. Kirkwood, M.D. *Vice-Presidents*—T. J. Walker, M.D., J.P., E. Worthington, G. W. Leigh. *Committee*—J. F. Perkins, W. H. Pentney, A. W. Nichols, W. Atkinson, T. W. Rogers. *Treasurer*—H. C. Lilley. *Secretary*—A. C. Taylor, Trinity Street, Peterborough.

Photographic Club.—(ESTABLISHED 1879.)—Meetings are held at Anderton's Hotel, Fleet Street, London, E.C. *Trustees*—Frank Haes and F. A. Bridge. *Committee*—E. W. Foxlee, H. Vivian Hyde, A. Mackie, H. Müller, E. A. Newell, Hutton P. Smith, H. Snowden Ward, Walter D. Welford. *Curator and Librarian*—Charles Wallis. *Secretary and Treasurer*—Edward A. Newell, 4 Maiden Lane, Queen Street, E.C.

Photographic Copyright Union.—(ESTABLISHED 1893.)—*President*—Frank Bishop. *Vice-President*—Joseph J. Elliott. *Committee*—Gambier Bolton, Warwick Brookes, W. E. Downey, A. Ellis, J. Magrath, J. Lillie Mitchell (Hon. Secretary), F. M. Sutcliffe. *Treasurer*—William Grove. *Secretary*—Henry Gower, London Chamber of Commerce, Botolph House, Eastcheap, E.C.

Photographic Society of Ireland.—(ESTABLISHED 1854.)—Meetings held at 35 Dawson Street, Dublin. *President*—J. A. C. Ruthven, A.M.I.C.E.I. *Vice-Presidents*—James Simpson and V. E. Smyth. *Council*—A. M. Geddis, R. M. Inglis, G. E. Matthews, R. L. Bewley, J. H. Gane, J. H. Woodworth, L. R. Strangways, H. Goodwillie, E. Webb, — Smith. *Treasurer*—William Bewley, B.A. *Secretary*—W. F. Cooper, 35 Dawson Street, Dublin.

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Photographic Convention of the United Kingdom.—(ESTABLISHED 1886.)—The Sixteenth Annual Meeting will be held at Oxford, July, 1901, under the Presidency of Sir William J. Herschel, Bart. Retiring President (Newcastle-on-Tyne, 1900), Thomas Bedding, F.R.P.S. The Photographic Convention of the United Kingdom was founded in 1886 for the advancement of photography, and to afford opportunities for personal intercourse and exchange of ideas amongst those interested in the art. The Council of the Convention is empowered to make grants from the surplus funds under its control, in aid of photographic research. Meetings have been held at the following centres:—Derby, Glasgow, Birmingham, London, Chester, Bath, Edinburgh, Plymouth, Dublin, Shrewsbury, Leeds, Great Yarmouth, Glasgow (second visit), Gloucester, and Newcastle-on-Tyne. *Past Presidents*—J. Traill Taylor, Andrew Pringle, C. H. Bothamley, George Davison, William Bedford, George Mason, Sir Howard Grubb, A. Haddon, H. P. Robinson, F. P. Cembrano, John Stuart, William Crooke. *Members of Council*—Harold Baker (London), C. A. Barkas (Newcastle-on-Tyne), W. Barry (Hull), James Baty (Newcastle-on-Tyne), Godfrey Bingley (Leeds), Walter S. Corder (Newcastle-on-Tyne), Alexander Cowan (London), W. E. Cowan (Newcastle-on-Tyne), W. J. Croall (Edinburgh), T. R. Dallmeyer (London), W. E. Dunmore (London), Dr. P. H. Emerson (Christchurch), S. H. Fry (London), F. Gandy (Derby), J. Pattison Gibson (Hexham), H. M. Hastings (London), E. J. Humphery (London), Sydney Keith (Hounslow), J. J. Kirkwood (Tynemouth), C. Phipps Lucas (London), Percy Lund (Bradford), J. L. Lyell (London), Colonel Lysaght (Pretoria, S.A.), A. F. Mowll (Liverpool), Rev. T. Perkins (Blandford), J. Porritt (Leicester), Ralph Robinson (Redhill), J. A. C. Ruthven (Dublin), A. Seaman (Chesterfield), H. Sturmey (Coventry), Alexander Tate (Belfast), W. Taylor (Leicester), J. J. Vezey (London), J. H. Walker (Leeds), E. J. Wall (London), H. Snowden Ward (London), S. B. Webber (London), G. Watmough Webster (Chester), J. B. B. Wellington (Elstree), A. Werner (Dublin). William Goodwin (Glasgow), R. W. Dugdale (Gloucester), and W. Thompson (Newcastle-on-Tyne), are by Rule XII. *ex-officio* members of Council for one, two, and three years respectively. Past-Presidents who remain members of the Convention are by Rule X. Vice-Presidents and *ex-officio* members of Council. *Trustees*—Samuel Blatchford Webber and Frederick Albert Bridge. *Hon. Secretary and Treasurer*—F. A. Bridge, East Lodge, Dalston Lane, London N.E.

Photographic Survey of Warwickshire.—(ESTABLISHED 1889.)—Meetings held at Birmingham. *President*—Sir J. B. Stone, M.P. *Treasurer*—G. F. Lyndon, J.P. *Secretaries*—J. H. Pickard, Priory Road, Edgbaston, and C. J. Fowler, Courts Lane, Erdington.

Plumstead (All Saints') Photographic Society.—(ESTABLISHED 1896.)—Meetings are held at the Mission Hall, Herbert Road. *President*—Rev. J. W. Morris, M.A. *Vice-Presidents*—Colonel N. S. S. Watkin, C.B., R.A., E. A. Hastings Jay, H. F. Donaldson, M.I.C.E., Rev. C. M. Gibbens, M.A. *Chairman*—H. Clutterbuck, M.I.M.E. *Committee*—Messrs. Arnold, Goldthorpe, Grant, and Stone. *Librarian and Assistant Secretary*—E. Kemp. *Secretary and Treasurer*—G. V. Taylor, 29 Vernham Road, Plumstead, S.E.

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Plymouth Photographic Society.—(Established 1894.)—Meetings are held at The Athenæum, George Street, Plymouth. *President*—J. Davey Turney. *Vice-Presidents*—G. F. Treleaven and C. H. Dymond. *Committee*—W. Anning, James Cock, W. H. Harris, A. W. Hicks, H. S. Hill, F. Johnson, E. G. Turney, F. A. Wiblin. *Delegates*—E. H. Micklewood and H. J. Heissett. *Auditor*—F. Pascoe. *Hon. Treasurer*—J. Trouern Trend. *Hon. Secretary*—Wilfrid Grist, 105 Old Town Street, Plymouth.

Plympton Photographic Society.—(Established 1894.)—*President*—Dr. Aldridge. *Committee*—Dr. Ellery, J. Brooking Rowe, C. H. Stevens, H. Tritton. *Hon. Secretary and Treasurer*—T. H. Weeks, Plympton House, Plympton, South Devon.

Polytechnic Photographic Society.—(Established 1890.)—Meetings held at Polytechnic Institute, 309 Regent Street, London, W. *President*—Howard Farmer. *Vice-Presidents*—Frank Hastings and F. W. Parker. *Committee*—C. E. Crake, C. Cronin, G. Goose, F. Lock, W. T. Pearson, W. M. Weir. *Treasurer*—Rowland Hill. *Secretary*—Frank Wilson, 5 Balderton Buildings, Hart Street, Grosvenor Square, W.

Poole Natural History Society.—(Established 1888, the Photographic Section 1897.)—Meetings are held at the Free Library Buildings, Poole. *President*—Reginald Aldridge. J.P. *Vice-Presidents*—Dr. W. Hooper Masters and Dr. William Turner, J.P. *Committee*—A. D. Moullin, Leonard W. Pike, Owen Carter, W. H. Hunt. *Treasurer*—Charles Carter, J.P. *Secretary*—J. R. Eldridge, 142 High Street, Poole.

Postal Camera Club.—(Established 1894.)—A circulating Club for advanced workers only. The portfolios circulate with regularity. Prints are inserted and withdrawn by the members as the portfolio arrives monthly. *Hon. Secretary*—W. R. Bland, Duffield, Derby.

Postal Photographic Club.—(Established 1886.)—*Committee for Judging Prints of Applicants for Vacancies*—Colonel J. H. Biggs, W. H. Banks, A. L. Hitchin. *Secretary and Treasurer*—Reginald A. R. Bennett, M.A. (Oxon.), Walton Manor Lodge, Oxford.

Prescot and District Amateur Photographic Association.—(Established 1897.)—Meetings held at Bank Buildings, Prescot. *President*—William Tyrer. *Committee*—J. Blaiklock (Chairman), F. V. Driffield, W. A. Cross, A. Tracey, J. S. Robinson, E. Taylor, E. Davies, B. A. Giuseppi, John Whitaker. *Treasurer*—C. T. Willis. *Secretary*—W. Langley, Plumbs House, Scotch Lane, Prescot, Lancashire.

Preston Scientific Society (Photographic Section).—(Established 1896.)—Meetings held at 119A Fishergate, Preston. *Chairman*—Rev. S. E. Collinson. *Vice-Chairman*—C. A. Swift, M.A. *Committee*—J. D. Marsden, J. H. Tonge, Henry P. Burton, W. Phillips, W. Croasdale, J. J. Shaw. *Secretary*—A. W. Cooper, 3 Stanley Terrace, Preston.

Pudsey District Photographic Society.—(Established 1891).—Meetings held at the Mechanics' Institute. *President*—Dr. Hunter. *Secretary and Treasurer*—R. Waring-Taylor, Boarding House, Fulneck, near Leeds.

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Ramsgate Camera Club.—(ESTABLISHED 1894.)—Meetings are held at the Victoria Hotel, Ramsgate. *Vice-Presidents*—E. E. Wastall, J.P., W. C. Bull, B.A., W. T. Davey. *Committee*—F. B. Bear, A. F. Dawkins, T. J. Dutton, G. Hoile, H. G. Holloway, H. Jackson, T. B. Smith, R. J. Smith, J. W. Vickery. *Secretary and Treasurer*--Frederick J. Bear, 1 Guildford Lawn, Ramsgate.

Redhill and District Camera Club.—(ESTABLISHED 1899.)—Meetings held in the North Room, Market Hall, Redhill. *Past President*—Dr. Dufton, D.Sc., M.A., F.C.S. *President*—William Brooks. *Vice-Presidents*—Miss S. E. Duncan, Miss Mabel Selly, J. O. Grant, Ralph W. Robinson, Frederick Izant, John Sterry, Henry Speyer, Mrs. Arthur Thompson. *Committee*—Rev. G. E. Belcher, M.A., James A. Carter, B.A., S. Wallace Peat, Harold G. Perry, William Rowlinson, Thomas B. Yates. *Hon. Lanternist*—Arthur H. Dunning. *Treasurer*—H. J. Blackler, M.B., M.R.C.S. *Secretaries*—Francis H. Ellwood (General), Dr. Dufton (Excursions), T. P. Padwick (Portfolio Section), Granville House, Station Road, Redhill.

Richmond Camera Club.—(ESTABLISHED 1890.)—Meetings held at the Greyhound Hotel, Richmond, Surrey. *President*—F. P. Cembrano. *Vice-Presidents*—G. Ardaseer and C. H. Davis. *Committee*—J. H. Alabaster, J. D. Gibson, C. G. Emery, E. Oetzmann. C. J. M. Child, J. W. St. John-Hunt. *Treasurer*—J. B. Huddy. *Secretaries*—H. Dale, 105 Sheen Road, Richmond, Surrey, and E. G. Richardson, 13 Dynevor Road, Richmond, Surrey.

Rochdale and District Photographic Society.—(ESTABLISHED 1890.)—Meetings held in Baillie Street Board Schools. *President*—J. A. Bright. *Vice-Presidents*—C. M. Royds, M.P., R. M. Jones, C. Fairbank, Alderman J. R. Heape, Rev. T. P. Spedding, Dr. Wilton Mills, W. Ingham. *Treasurer*—W. Bamford, M.P.S. *Hon. Secretaries*—J. W. Jones and E. H. Seanor.

Rodley Photographic Society.—(ESTABLISHED 1893.)—Meetings are held at Rodley, near Leeds. *President*—G. W. Bentley. *Vice-President*—H. Hardaker. *Yorkshire Photographic Union Delegate*—J. F. Ashby. *Treasurer*—H. Hardaker. *Secretary*—H. Crossley, Rodley, near Leeds.

Röntgen Society.—(ESTABLISHED 1896.)—Meetings are held at 20 Hanover Square. *President*—John Macintyre, M.B., F.R.S. Edin. *Past Presidents*—Prof. Silvanus P. Thompson, F.R.S., C. W. Mansell-Moullin, M.D. Oxon., F.R.C.S., Wilson Noble. *Vice-Presidents*—Lord Blythswood, The Right Hon. the Earl of Crawford, F.R.S., Prof. D. Ferrier, M.D., F.R.S., J. H. Gladstone, D.Sc., F.R.S., F.C.S., A. A. Campbell Swinton, M.I.C.E., M.I.E.E., Prof. Dawson Turner, M.D. *Hon. Members*—Prof. Röntgen, Sir W. Crookes, F.R.S., Prof. C. V. Boys, F.R.S., Prof. Oliver J. Lodge, F.R.S., Herbert Jackson, F.C.S. *Council*—Barry Blacker, M.D., B.S., J. Mackenzie Davidson, M.B., J. H. Gardiner, A. W. Isenthal, F.R.P.S., E. Payne, M.A., F. S. Pepperdene, M.A., Ph.D., J. J. Vezey, F.R.M.S., H. Snowden Ward, F.R.P.S., W. Webster, F.C.S., J. Wimshurst, F.R.S., Hugh Walsham, M.A., M.D., Chisholm Williams, F.R.C.S. *Hon. Secretary*—F. H. Low, M.B., 12 Sinclair Gardens, West Kensington, W.

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Rossendale Camera Club.—(Established 1894.)—Meetings are held at the British Women's Rooms, Lord Street, Rawtenstall. *President*—George Pickup. *Committee*—J. Taylor, J. Butterworth, T. Simpson, W. Palmer, G. W. Heyworth. *Treasurer*—E. R. K. Taylor. *Secretary*—J. E. Eastwood, Bury Road, Rawtenstall.

Rotherham Photographic Society.—(Established 1889.)—Meetings held at 5 Frederick Street, Rotherham. *President*—Dr. F. J. Baldwin. *Vice-Presidents*—E. J. Hubbard, W. Rider, J. Leadbeater. *Council*—Messrs. Cox, Stamp, Oldham, Caseldine, and Firth. *Hon. Treasurer*—A. S. Lyth. *Hon. Secretary*—H. C. Hemmingway, Tooker Road, Rotherham.

Royal Cornwall Polytechnic Society.—(Established 1833).—Meetings held at Falmouth. *Patroness*—Her Most Gracious Majesty the Queen. *Vice-Patron*—H.R.H. the Prince of Wales, K.G. *President*—The Lord Bishop of Truro. *Vice-Presidents*—A. F. Basset, F. Layland-Barratt, M.A., LL.B., Frederick V. Hill, Arthur Willmore, Sir Edwin Durning-Lawrence, Bart., M.P., Sir Joseph Fayrer, Bart., M.D., F.R.S., K.C.S.I., Robert Fox, Henry S. Tuke, A.R.A., Sir Walter Trevelyan, Bart., Rev. J. S. Flynn, B.D., Alfred Bache, Assoc. Inst. M.E., Thurstan C. Peter. *Treasurer*—R. M. Tweedy. *Secretary*—Edward Kitto, F.R.Met.S., The Observatory, Falmouth.

Royal Photographic Society.—(Established 1853.)—Meetings are held at 66 Russell Square, London, W.C. *President*—Thomas R. Dallmeyer, F.R.A.S. *Vice-Presidents*—The Right Hon. the Earl of Crawford, K.T., F.R.S., Chapman Jones, F.I.C., F.C.S., Major-General J. Waterhouse, I.S.C., Sir H. Trueman Wood, M.A. *Council*—Thomas Bedding, T. Bolas, F.I.C., F.C.S., C. H. Bothamley, F.I.C., F.C.S., F. A. Bridge, A. Cowan, W. E. Debenham, W. B. Ferguson, Q C., M.A., Rev. F. C. Lambert, M.A., A. Mackie, J. W. Marchant, Prof. R. Meldola, F.R.S., E. Sanger Shepherd, J. A. Sinclair, J. Spiller, F.I.C., F.C.S., J. W. Swan, M.A., F.R.S., W. Thomas, J. J. Vezey, E. J. Wall, H. Snowden Ward, J. B. B. Wellington. *Editor of the Journal*—Sir W. de W. Abney, K.C.B., F.R.S. *Hon. Solicitor*—F. Ince. *Hon. Librarian*—H. Wilmer. *Hon. Treasurer*—G. Scamell. *Hon. Secretary*—John A. Hodges. *Assistant Secretary*—A. W. W. Bartlett, 66 Russell Square, London, W.C.

Scarborough and District Photographic Society.—(Established 1893.)—Meetings are held in the Museum, Scarborough. *President*—James Henry Rowntree. *Vice-President*—Dr. Frederic Dale. *Committee*—Miss McCallum, Miss Graham, Dr. Harvey, E. R. Cross, A. H. Robinson, T. F. Brogden, G. Whitfield. *Treasurer*—J. Whitfield. *Secretary*—Harry Wanless, 31 Westborough, Scarborough.

Shaw Church Institute Photographic and Art Society.—(Established 1888.)—Meetings are held at Shaw Church Institute. *President*—J. R. Royds. *Vice-President*—Rev. J. T. Ormerod, M.A. *Committee*—J. Watson, J. Clarkson, J. H. Broadbelt. *Secretary and Treasurer*—John Maiden, 93 Rochdale Road, Shaw, near Oldham.

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Sheerness Camera Club.—(ESTABLISHED 1896.)—Meetings held at the Conservative Club, The Broadway. *President*—Lieut. T. E. Dexter. *Vice-President*—J. Kingwell. *Committee*—J. Small, E. Tatham, A. E. Doran, Corporal Jones, R.G.A. *Treasurer*—W. H. Jago. *Secretary*—Frederick Cork, 16–18 and 53 High Street, Sheerness-on-Sea.

Sheffield and Hallamshire Photographic Society.—(ESTABLISHED 1896.)—Meetings are held at 218 Fitzwilliam Street, Sheffield. *President*—F. Mottershaw. *Vice-Presidents*—G. H. Bagshaw, F. Evans, L. Britton. *Committee*—Messrs. Heathcote, Robinson, Leech, G. Bingham, A. Bingham, Cunningham, Ellis, and Belling. *Treasurer*—J. W. Mottershaw. *Hon. Secretary*—Fred Lowe, Brook Villas, Carrington Road, Ecclesall, Sheffield.

Sheffield Optical Lantern Society.—(ESTABLISHED 1890.)—Meetings held at St. Paul's Schools, Cambridge Street, third Thursday in the month. *President*—Dr. J. A. Manton. *Vice-Presidents*—J. H. Lygo, J. W. H. Wilson, Hy. Staniforth. B. Carr, J. Clowes. *Council*—J. Temperton, M. Wilson, C. Thornhill, J. E. Glenn, T. W. Simonson, J. Cunningham, S. Hughes. H. J. Claque, J. W. Copley. *Reporter*—J. Cunningham. *Treasurer*—E. Copley. *Secretary*—T. G. F. Allen, 59 Melrose Road, Sheffield.

Sheffield Photographic Society.—(ESTABLISHED 1876.)—Affiliated with the Yorkshire Photographic Union. Meetings are held at the Masonic Hall, Surrey Street, on the first Tuesday in each month. *President*—George H. Day. *Vice-Presidents*—George Tomlinson, G. W. Blackwell, J. H. Lygo. *Council*—Sparham Camp, W. T. Furniss, H. Hill, A. W. Hill, J. Smith. *Reporter*—J. W. Wright. *Librarian*—Charles F. Brindley. *Treasurer*—T. G. Hibbert. *Secretary*—Thomas H. Muxlow, 136 Steade Road, Sharrow.

Shropshire Camera Club.—(ESTABLISHED 1886.) *President*—W. D. Haydon. *Vice-Presidents*—M. J. Harding, J. L. Della-Porta, W. D. Haydon, J. R. Greatorex. *Council*—F. R. Armytage, W. E. Harding, P. W. Pilcher, H. W. Hughes, R. J. Irwin, H. H. Hughes. *Hon. Treasurer*—H. Atkin. *Hon. Secretary*—Wilfrid E. Salt, Quarry Place, Shrewsbury.

South London Photographic Society.—(ESTABLISHED 1888.)—Affiliated with the Royal Photographic Society. Meetings are held at Hanover Hall, Hanover Park, Rye Lane, Peckham, S.E. *Patrons*—His Grace the Duke of Newcastle and G. A. Maull. *President*—Charles H. Oakden, F.R.P.S. *Vice-Presidents*—Maurice Howell, M.P.S., S. W. Gardner, W. F. Slater, F.R.P.S., A. E. Allen, J. T. French. *Committee*—G. Brown, E. R. Bull, C. Churchill, C. F. Dickinson, A. Fellows, W. Howell, E. Mathews, E. G. Ruckes, G. J. T. Walford. *Curator*—W. C. Boyce. *Hon. Lanternist*—H. F. Mawbey. *Captain of the Cyclist Section*—H. Esler. *Vice-Captain*—F. W. Grigg. *Delegates to the Affiliation of Photographic Societies*—Charles H. Oakden, F.R.P.S., and Frank Goddard. *Hon. Treasurer*—E. A. Whitby. *Hon. Secretary*—F. Goddard, Woodlands, Vanbrugh Hill, Blackheath, S.E. *Hon. Assistant Secretary*—S. W. Whiteman, 8 Camberwell Road, S.E. *Hon. Excursion Secretary*—H. C. Beckett, 44 St. Mary's Road, Peckham, S.E.

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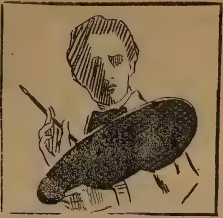
and Still First.



Society for the Encouragement of Arts, Manufactures, and Commerce.—(FOUNDED IN 1754. INCORPORATED BY ROYAL CHARTER IN 1847.)—Meetings are held at John Street, Adelphi, London, W.C. *Council*—H.R.H. the Prince of Wales, K.G. (President of the Society), Sir John Wolfe-Barry, K.C.B., LL.D , F.R.S. (Chairman of the Council), H.R.H. the Duke of York, K.G. (Vice-President), Sir Frederick Abel, Bart., K.C.B., D.C.L., D.Sc., F.R.S. (Vice-President), Duke of Abercorn, K.G., C.B. (Vice-President), Lord Avebury, D.C.L., F.R.S. (Vice-President), Sir Benjamin Baker, K.C.M.G., F.R.S. (Vice-President), Sir Steuart Colvin Bayley, K.C.S.I., C.I.E. (Vice-President), Lord Belhaven and Stenton (Vice-President), Sir Frederick Bramwell, Bart., D.C.L., F.R.S. (Treasurer), Major-General Sir Owen Tudor Burne, G.C.I.E., K.C.S.I. (Vice-President), Michael Carteighe, F.C.S. (Vice-President), R. Brudenell Carter, F.R.C.S. (Vice President), B. Francis Cobb (Treasurer), Lewis Foreman Day, Sir Edwin Durning-Lawrence, Bart., M.P. (Vice-President), Sir John Evans, K.C.B , F.R.S. (Vice-President), Henry Graham Harris (Vice-President), Sir Charles Malcolm Kennedy, K.C.M.G., C.B. (Vice-President), Sir William Lee-Warner, K.C.S.I., M.A., Sir Villiers Lister, K.C.M.G. (Vice-President), Ludwig Mond, Ph.D , F.R S. (Vice-President), Hon. Richard Clere Parsons (Vice-President), Sir Westby B. Perceval, K.C.M.G., Sir William Henry Preece, K.C.B., F.R.S., Sir Walter S. Prideaux, Sir Owen Roberts, M.A., D.C.L., F.S.A. (Vice-President), Sir William Chandler Roberts-Austen, K.C.B., F.R.S., The Lord Chief Justice, G.C.M.G. (Vice-President), Alexander Siemens, Lord Strathcona and Mount Royal, G.C.M G., LL.D. (Vice-President), Sir Thomas Sutherland, G.C.M.G., M P. (Vice-President), Joseph Wilson Swan, F.R.S., Prof. John Millar Thomson, LL.D., F.R.S., John I. Thornycroft, F.R.S., Sir William Henry White, K.C.B., LL.D., F.R.S. (Vice-President). *Auditors*—Knox, Cropper, & Co. *Secretary*—Sir Henry Trueman Wood, M.A. *Assistant Secretary*—Henry B. Wheatley, F.S.A.

Southampton Camera Club.—(ESTABLISHED 1896.)—Meetings held at the Kell Memorial Hall, Bellevue. *President*—Rev. E. C. Bennett. *Vice-Presidents*—A. Horsley Hinton and G. T. Vivian. *Council*—F. Morgan, J. Compton, W. Jarvis, S. Thorne, F. Winzar. *Lanternist*—E. J. Evans. *Treasurer*—W. H. Trigg. *Secretary*—S. G. Kimber, Oakdene, Highfield, Southampton.

South Norwood Photographic Club.—Meetings held at the Polytechnic, South Norwood. *President*—W. F. Stanley. *Vice-President*—Rev. H. D. Hinde. *Committee*—Miss Bedford, Miss Lambert, G. R. Beckett, R. S. Dick, F. E. Fergusson, B. T. Luckett, D. H. Somerville, T. Williams. *Treasurer*—John Smith. *Hon. Secretary*—E. Pierce, 26 Balfour Road, South Norwood.

Southport Social Photographic Club.—(ESTABLISHED 1890.)—Meetings are held at The Studio, 15 Cambridge Arcade. *President*—Thomas Ormrod. *Vice-Presidents*—Charles H. Brown and E. W. Johnson. *Committee*—D. E. Benson, S. Blackshaw, W. P. Brown, H. J. Heaton, W. Rees. *Treasurer*—James R. Cane. *Secretary*—George Cross, 15 Cambridge Arcade, Southport.

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Southport Y.M.C.A. Camera Club.—(ESTABLISHED 1896.)—Meetings held at the Y.M.C.A. Rooms, Eastbank Street, Southport. *President*—S. J. Elliott. *Vice-Presidents*—Henry Ball and S. R. Parks. *Committee*—S. Y. Ormerod, E. W. Mellor, P. Dickinson, T. E. Harrison, W. H. G. Lea. *Treasurer*—J. T. Rigby. *Secretary*—F. B. Jesper, 8 Promenade, Southport.

Southsea Amateur Photographic Society.—(ESTABLISHED 1888.)—Meetings are held at Headquarters, 5 Pembroke Road, Portsmouth. *President*—H. T. Lilley, M.A. *Vice-President*—Dr. C. H. Newby. *Council*—Colonel H. W. B. Bruno, Dr. F. Lord, P. R. Denham, G. Whitefield, E. H. Purvis, H. A. Canning, L.D.S. *Hon. Lanternist*—L. Dyer. *Treasurer*—W. G. Lewis. *Secretary*—Gilbert Wood, 10 Pelham Road, Southsea. *Hon. Assistant Secretary*—F. O. Field.

South Shields Photographic Society.—(ESTABLISHED 1894, REORGANIZED 1898.)—Meetings are held at the Y.M.C.A. Rooms, Charlotte Terrace, South Shields. *President* — J. Davenport. *Vice-Presidents* — A. E. Cowling, H. G. Fowler, W. Parry, A. J. Hunter, W. Hoare. T. E. Taber. *Committee*—W. E. Beck, H. Clark, J. Kyle, W. Short, — McClarence, R. Brady. *Steward*—T. E. Taber. *Auditor*—W. E. Beck. *Treasurer*—M. H. Sadler. *Secretary*—A. W. Hoare, 53 Wouldhave Street, South Shields.

Stafford Photographic Society.—(ESTABLISHED 1895.)—Meetings held at the Y.M.C.A. Rooms, Crabbery Hall, Stafford. *President*—F. Cliff. *Vice-President*—M. Averill. *Committee*—H. Cliff, H. W. Cooper, T. W. Davies, W. Kirkham. *Treasurer*—George Wray. *Secretary*—Henry E. Burn, Totnam Villa, Stone Road, Stafford.

Stalybridge Camera Club.—(ESTABLISHED 1897.)—Meetings are held in the Club's Rooms, Market Street, Stalybridge. *President*—Alderman Fentem, J.P. *Vice-Presidents*—Alderman Simpson and David Innes. *Committee*—H. Fentem, D. Maclaren, F. Thompson, C. E. Holden, William Kershaw, T. Hilton, J. H. Fielding, J. J. Fielding. *Treasurer*—B. Wainwright. *Secretary*—John W. Gill, 14 Astley Street, Stalybridge.

Stereoscopic Club.—(ESTABLISHED 1890.)—Meetings held at 26 King Street, Manchester. *President* — James Whitelegg. *Treasurer* — F. Hallowell. *Secretary*—W. I. Chadwick, 26 King Street, Manchester.

Stereoscopic Society.—(ESTABLISHED 1893.)—*President*—Dr. W. Stainthorpe, J.P., M.D., &c. *Vice-Presidents*—Herr Victor Selb and F. Dunsterville. *Secretary and Treasurer*—B. Diveri, B.A., Viewfield, Huntly, N.B.

St. Bartholomew's Hospital Photographic Society.—(ESTABLISHED 1890.)—Meetings are held at St. Bartholomew's Hospital. *President*—H. Lewis Jones, M.D., F.R.C.P. *Vice-Presidents*—J. Calvert, M.D., B.Sc., F.R.C.P., and B. Horder, M.D., F.R.C.P. *Committee*—P. Tatchell, H. Gask, M.R.C.S., L.R.C.P., T. H. Gandy, M.R.C.S., L.R.C.P., E. P. Sewell, M.R.C.S., L.R.C.P. *Secretary and Treasurer*—R. T. Cooke St. Bartholomew's Hospital.

For . .
SKILFUL ENLARGING
By BROMIDE
PROCESS.

St. Michael's Photographic Club.—(ESTABLISHED 1896.)—Meetings held at the Church Institute, St. Michael's-in-the-Hamlet, Liverpool. *President*—Rev. H. Gresford Jones, M.A. *Secretary*—R. J. Lutas, 17 Elsmere Avenue, Sefton Park, Liverpool.

Stockport Photographic Society.—(ESTABLISHED 1889.)—*President*—Colonel Turner, J.P. *Committee*—T. Allott, J. Rothwell, W. Gosling, J. Barlow, H. Beswick, W. Wells, S. Platt. *Hon. Treasurer*—J. Middleton. *Hon. Secretary*—Thomas Gould, 116 Chestergate, Stockport.

Stoneycroft (Liverpool) Camera Club.—(ESTABLISHED 1895.)—Meetings are held in the People's Hall, Prescot Road, Stoneycroft. *President*—Dr. Ivor Thomas. *Vice-Presidents*—C. E. Hancox and W. S. Cook. *Council*—W. E. Inston, G. E. Gidman, F. Walmsley, T. R. Olver. *Hon. Lanternist*—Herbert Johnson. *Hon. Secretary and Treasurer*—M. Short, 4 Harriet Terrace, Queen's Road, Liverpool.

Sun & Company.—(ESTABLISHED 1886.)—A Postal Photographic Society for advanced workers, limited to forty amateurs, for the monthly circulation and criticism of photographs, entirely the work of members, and for a general interchange of ideas, with a view to mutual advancement in the science and art of photography. *Committee*—H. Newson, Colonel Biggs, Wallace Heath, and the Hon. Secretary. Application for vacancies should be made to the Hon. Secretary, Martin J. Harding, Myrtle Villa, Hawthorn Road, Shrewsbury.

Sunbeam Postal Photographic Society.—(ESTABLISHED 1890.)—An ever-circulating portfolio to members monthly for criticisms, discussions, and occasional competitions. *Secretary*—R. W. Copeman, Henstridge, Blandford, Dorset.

Sunderland Camera Club.—(ESTABLISHED 1899.)—*President*—Campbell R. Pinkney. *Committee*—C. R. Pinkney, C. T. Cothay, F. W. Common, S. Ord, H. W. Wardropper. *Secretary*—H. Wallis Wardropper, 19 Belle Vue Park, Sunderland.

Sunderland Photographic Association.—(ESTABLISHED 1888.)—Meetings held at the Café, Fawcett Street. *President*—William Milburn. *Vice-Presidents*—William Bartram and Charles E. Cowper. *Council*—J. W. Broderick, G. Bartram, A. Peddie, W. Horan, R. G. Postgate, T. Walton, W. E. Kieffer, J. Deans, R. Hodgson. *Secretary and Treasurer*—W. J. Pope, New Arcade, Sunderland.

Sutton Photographic Club.—(ESTABLISHED 1896.)—Meetings held at Public Hall Chambers, Sutton, Surrey. *President*—E. De Clifford, B.A. *Vice-President*—J. A. Formoy, F.R.A.S. *Committee*—C. J. Marshall, H. C. Marshall, W. Hooper, A. D. Collins. *Secretary and Treasurer*—A. P. Hoole, The Willows, Sutton, Surrey.

Talbot Album Club.—(ESTABLISHED 1886.)—*Secretary*—Frederick H. Davies, Hampton-in-Arden, Warwickshire.

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'The Argosy' Postal Photographic Club.—(ESTABLISHED 1887.)—*Secretary*—Rev. C. F. Lowry Barnwell, Stramshall Vicarage, Uttoxeter.

The Guild, Leeds.—(ESTABLISHED 1900.)—Meetings are held at 115 Albion Street (*pro tem*). *Hon. Secretary*—R. Stockdale, 17 Mount Preston, Leeds.

Thornton Heath Polytechnic Photographic Society.—(ESTABLISHED 1899.)—*President*—C. Owen Fowler, M.D. *Vice-Presidents*—Councillor G. S. Addison, Alderman G. J. Allen, J.P., F. O. Bynoe, R. Child Bayley, F.R.P.S., Rev. G. A. Lewis, M.A. *Committee*—Mrs. F. O. Bynoe, A. B. Chatwood, T. Duff Smith, B. E. Edwards, Mrs. B. E. Edwards, G. Edwards, J. H. Robertson, W. H. Rogers, W. Swale. *Hon. Treasurer*—T. Ironmonger. *Hon. Secretary*—W. Burwell Smith, 34 Ecclesbourne Road, Thornton Heath.

Trinity College (Glenalmond) Photographic Club.—Meetings are held at Glenalmond. *President*—A. S. Reid. *Vice-President*—E. S. Lyttel. *Committee*—A. S. Reid, E. S. Lyttel, K. Barge, J. C. Henderson-Hamilton, G. S. Kennedy. *Treasurer*—J. C. Henderson-Hamilton. *Secretary*—K. Barge, Trinity College, Glendalmond, Perth, N.B.

Tunbridge Wells Amateur Photographic Association.—(ESTABLISHED 1887.)—Meetings held at the Club Room, Mechanics' Institute, Dudley Road. *Patron*—Sir David Salomons, Bart. *President*—F. G. Smart, M.A. *Vice-Presidents*—E. R. Ashton, Rev. A. T. Scott, M.A., J. Sidney Snelgrove. *Committee*—J. H. Chapman, A. W. Pierson, J. H. Spencer, H. Wild. *Treasurer*—B. Whitrow. *Secretary*—Joseph Chamberlain, Tankerville, Cambridge Street.

Ulster Amateur Photographic Society.—(ESTABLISHED 1885.)—Meetings held at the Museum, College Square, N. Belfast. *President*—W. E. Wiallmes. *Committee*—E. Bingham, Thomas N. Murray, S. K. Kerker, James M'Cleery, D. Elliott, John Wylie, B.A. *Treasurer*—J. Campbell Carson. *Secretary*—J. Campbell Carson (*pro tem.*), The Museum, College Square, N. Belfast.

Uttoxeter Photographic Society.—(ESTABLISHED 1890.)—Meetings are held at Carter Street, Uttoxeter. *President*—Rev. C. F. L. Barnwell. *Vice-Presidents*—F. A. Bolton and C. W. Lyon. *Committee*—S. B. Bamford, J.P., H. Holmes, Alfred Parker, R. Walker, E. Edwards, R. T. Hardy. *Treasurer*—R. T. Hardy. *Secretary*—Rev. C. F. L. Barnwell, Stramshall Vicarage, Uttoxeter.

Wakefield Photographic Society.—(ESTABLISHED 1891.)—Meetings are held at the Church Institution. *President*—Charles Miles. *Vice-Presidents*—H. M. Briggs and W. Holmes. *Committee*—J. A. Cass, J. H. Chaplain, J. Kitson, W. Norwood, A. W. Stanfield, W. Woodhead. *Treasurer*—F. Judge. *Secretary*—R. Robson, 1 Dunelm Terrace, Sandal, Wakefield.

For . .

FINEST ENLARGING

in CARBON
or PLATINOTYPE.

Walsall Amateur Photographic Society.—(Established 1892.)—Meetings are held at the Y.M.C.A., Walsall. *President*—S. A. Newman. *Committee*—W. H. Bullock, W. C. Checkley, T. B. Edwards, W. A. Hubball, W. Meikle, S. A. G. Newman, F. Partridge, H. B. Smith, George Warner. *Secretary and Treasurer*—E. A. Day, 53 Lichfield Road, Walsall.

Walthamstow Photographic Society.—(Established 1894.)—Meetings held at Mission Hall, Vestry Road. *President*—W. A. Longmore. *Committee*—James Cox, A. J. Edwards, W. H. Judson, Thomas R. Nunn, C. S. Scott, Thomas Willats. *Hon. Treasurer*—Eben. Clarke. *Hon. Secretary*—E. W. Appleton, 60 Grosvenor Park Road, Walthamstow.

Walton (Liverpool) Photographic Society.—(Established 1889.)—Meetings held at the Walton Church Schools, Liverpool. *President*—George Latimer. *Council*—F. O. Creswell, J. Parke, F. Murphy, H Whittle, W. W. Maver, M. Dullehen. *Hon. Secretary and Treasurer*—T. Bickerstaff, 79 Rawcliffe Road, Walton, Liverpool.

Warrington Photographic Society.—(Established 1887.)—Meetings held at Druids' Hall, Sankey Street, Warrington. *President*—H. Bond. *Vice-Presidents*—J. Fairhurst, H. N. Houghton, J. Harding. *Council*—Messrs. Cavanagh, Armstrong, Landon, Holt, Gandy, Twiss, Winstanley, and Wilkinson, together with the Officers. *Secretary*—F. W. Knowles, 77 Bridge Street, Warrington.

Waterloo and Blundellsands Photographic Society.—(Established 1893.)—Meetings are held at the Club Rooms, 65 St. John's Road, Waterloo. *President*—Howard Banister. *Vice-Presidents*—J. T. Norman-Thomas, F.L.S., G. E. H. Rawlins. *Committee*—H. Banister, G. E. H. Rawlins, William G. Eyre, C. Muspratt, H. J. Woodley. *Treasurer*—William G. Eyre. *Secretary*—H. J. Woodley, Merton Bank, South View, Waterloo.

West Bromwich Municipal Science School Photographic Society.—Established 1898.)—Meetings held at the Institute, West Bromwich. *President*—R. Lloyd Whiteley, F.I.C., F.C.S. *Vice-President*—H. R. Prescott. *Committee*—F. W. Cotterell, T. W. Eayres, F. V. Wilkinson, D. G. Mackintosh. *Secretary and Treasurer*—R. Leach, 47 Birmingham Road, West Bromwich.

West London Photographic Society.—(Established 1888.)—Meetings held at the Lecture Hall, Hammersmith, W. *President*—W. J. Bull, M.P. *Vice-President*—W. Collett. *Council*—A. C. Beard, W. A. Brown, A. Ebbs, L. Selby, G. F. Blackmore, M. W. Cockerell, G. Lamley, H. Selby. *Lanternist*—R. Horton. *Librarian*—W. Taylor. *Hon. Treasurer and Assistant Hon. Secretary*—A. E. Cockerell. *Hon. Secretary*—J. Brown, 28 Weltje Road, Ravenscourt Park, W.

Weymouth Photographic Society.—Meetings are held at the Technical Schools, Weymouth. *Hon. Secretary*—F. C. Mace, 105 St. Mary Street, Weymouth.

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West Surrey Photographic Society.—(Established 1887.)—Meetings held at the Railway Hotel, 110 Battersea Rise, Clapham Junction, S.W. *President*—J. T. Price. *Vice-President*—J. Bulbeck. *Committee*—R. Archer, W. H. Marriott, C. Sheed, S. Smith, A. Rose. *Hon. Librarian*—A. E. Lamb. *Hon. Secretary and Treasurer*—W. H. Wilshere, 236 Lavender Hill, Clapham Junction, S.W.

Whitby Camera Club.—(Established 1897.)—Meetings held at Mr. Newbitt's, West Cliff Private Hotel. *President*—Edmund Hall. *Vice-Presidents*—William Brown and Thomas Newbitt. *Committee*—J. Brooks, J. Bruce, Dr. Sharp, H. S. Horne, William Ruff, R. Coulman. *Hon. Secretary*—G. S. French, 1 West Terrace, Whitby.

Widnes Photographic Society.—(Established 1893.)—Meetings are held at Bedford Chambers, Victoria Road, Widnes. *President*—G. J. Warner. *Vice-Presidents*—V. C. Driffield and J. Newburn. *Council*—J. S. Sinclair, R. J. Gow, A. J. Squires, J. Pilling, A. Midwood. *Treasurer*—T. Cosier. *Secretary*—J. W. Towers, Victoria Road, Widnes.

Wolverhampton Camera Club.—(Established 1898.)—Meetings are held at members' houses. *Secretary*—Harold Holcroft, M.A., F.C.S., Parkdale, Wolverhampton.

Woodford Photographic Society.—(Established 1893.)—Meetings are held at the Wilfrid Lawson Hotel, Woodford Green. *President*—H. T. Malby, F.R.P.S. *Vice-President*—A. Horsley Hinton. *Council*—All the Officers and Messrs. Croom and Wastall. *Affiliation Delegates*—E. Marriage, F.R.P.S., and J. P. W. Goodwin. *Secretary and Treasurer*—F. G. Emler, 1 Florence Villas, Chelmsford Road, Woodford.

Woolwich Photographic Society.—(Established 1892.)—Meetings held at St. John's Schools, Woolwich. *President*—C. Churchill. *Vice-Presidents*—W. H. Dawson, J. Desforges, J. Borthwick Panting, F.R.P.S. *Council*—J. Cregan, J. Hope, A. Harris, G. Newerthagen, W. Slater G. Tapp. *Secretary and Treasurer*—F W. Machen, 161 Griffin Road Plumstead. *Assistant Secretary*—S. Haglesdon.

Worcestershire Photographic Survey Society.—(Established 1897.)—Meetings held at the Victoria Institute, Worcester. *President*—J. W. Willis Bund. *Vice-Presidents*—Lord Cobham, Lord Hampton, The Hon. A. Percy Allsopp, Michael Tomkinson, George E. Abell, John Corbett, Frederick Corbett. *Council*—J. W. Willis Bund, F. Corbett, T. Duckworth, R. H. Murray, F. Ronald Jeffrey, C. R. Sayer, T. J. Hobson, Rev. E. N. Dew, F. E. Hill, T. B. Judson, J. Cam, W. L. Frost, J. F. Santonna, S. Hill, T. James, J. Page Croft. *Hon. Auditor*—T. James. *Hon. Treasurer*—Mrs. Berkeley. *Hon. Secretaries*—C. R. Sayer and T. J. Hobson, 15 Albany Terrace, Britannia Square, Worcester.

Worcester Tricycle Club (Camera Section).—(Established 1892.)—Meetings are held at the Bell Hotel, Worcester. *President*—J. Wilkes. *Vice-President*—J. H. White. *Council*—W. Boughton, J. J. Cam, W. H. Cam, S. Hill, T. James, T. B. Judson. *Treasurer*—F. E. Hill. *Secretary*—T. J. Hobson, 15 Albany Terrace, Britannia Square, Worcester.

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Wycombe Camera Club.—(ESTABLISHED 1892.)—Meetings held at the South Bucks Auction Mart, Wycombe. *President*—W. Howland. *Committee*—Messrs. Broughton, Turner, Norton, Sherriff, Burton, Fox. *Secretary and Treasurer*—J. Wilford, 7 High Street, High Wycombe.

Yeadon and District Photographic Society.—(ESTABLISHED 1896.)—Meetings held at the Lecture Hall, Yeadon. *President*—F. T. Coupland. *Vice-Presidents*—George Proctor, R. P. Jibson, Dr. Muschamp. *Committee*—T. Pratt, E. E. Slater, T. A. Womersley, A. Myers, W. E. Fearnley. *Secretary and Treasurer*—C. Smith, Greenside, Yeadon, Leeds.

York Photographic Society.—(ESTABLISHED 1888.)—Meetings are held at the Victoria Hall, York. *President*—W. Weatherill. *Vice-President*—A. Hardcastle. *Council*—Messrs. Brown, Dickinson, Hirst, Vincent, Saville, and Dent. *Treasurer*—R. Bainbridge. *Secretary*—Frederic G. P. Benson, 50 Scott Street, York.

Yorkshire Philosophical Society (Photographic Section).—(ESTABLISHED 1888.)—Meetings are held at the Museum, York. *President*—Tempest Anderson, M.D., J.P. *Vice-President*—J. Kitching. *Secretary and Treasurer*—H. Dennis Taylor, Trenfield, Holgate, York.

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COLONIAL PHOTOGRAPHIC SOCIETIES.

Amateur Photographic Association of Victoria, Melbourne.—(Established 1883.)—Meets monthly on the second Tuesday in each month, Informal Meetings on the fourth Monday in the month, at the Royal Society's Hall, Victoria Street, Melbourne. *President*—Dr. Kaufmann. *Hon. Secretary*—J. H. Harvey.

Amateur Photographic Society of Madras.—(Established 1888.)—Meetings are held at the Masonic Hall, Mount Road, Madras. *President*—C. Michie Smith, B.Sc., F.R.S.E. *Vice-Presidents*—F. Dunsterville and C. E. Phipps. *Committee*—Mrs. Bedford, A. Chatterton, W. H. Oakes, A. Pilkington, Surgeon-Major-General Sibthorpe, C.B. *Treasurer*—V. G. Lynn. *Secretary*—S. Jackson, F.I.C., c/o Messrs. Binny & Co., Madras.

Auckland Photographic Club, New Zealand.—(Established 1885.)—Meetings held at the Club Rooms, Grey Street. *President*—Dr. J. Logan Campbell. *Vice Presidents*—J. R. Hanna, J. Martin, E. A. Payton. *Treasurer*—W. Gatenby. *Secretary*—H. R. Arthur, c/o Auckland Gas Company, Limited, Wyndham Street.

Ballarat Photographic Club, Ballarat, Victoria.—(Established 1880.)—Meetings are held in the School of Mines, Ballarat. *President*—Professor A. Mica Smith. *Vice Presidents*—R. J. Miller and E. Shew. *Committee*—Professor E. J. Dawbarn, R. Radcliffe, W. H. Wooster, Misses E. Purkiston, E. Baker, E. Stitfold. *Treasurer*—Mr. Hamburger. *Secretary*—Frederick J. Martell, School of Mines, Ballarat.

Barossa Camera Club, Nuriootpa, South Australia.—*Hon. Secretary*—Walter J. Ponder.

Bendigo Amateur Photographic Society.—Meetings held at the School of Mines. *President*—J. W. Faul. *Hon. Secretary*—F. Napoli Prescott.

Canterbury Philosophical Institute (Photographic Section), Christchurch, New Zealand.—Meetings held on second Tuesday in each month. *Hon. Secretaries*—S. Page and R. C. Bishop.

Cape Town Photographic Club.—(Established 1890.)—Meetings are held at the Y.M.C.A., Cape Town. *Hon. President*—Dr. Gill, C.B., F.R.S. *Vice-President*—Dr. Muir. *Committee*—T. H. Watson, A. Gracie, G. Ainslie, J. Denham, E. J. Steer, A. McLeod, A. J. Fuller, J. P. Edwards. *Hon. Secretary and Treasurer*—H. Bishop

Central Queensland Amateur Photographic Club, Rockhampton.—*Hon. Secretary*—H. V. Sankey.

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Dunedin Photographic Society, Dunedin, New Zealand.—(ESTABLISHED 1870.)—Meetings are held at the Rooms, Liverpool Street, Dunedin. *President*—C. W. Kerr. *Vice-Presidents*—A. Hamilton and R. A. Ewing. *Committee*—W. Williams, J. C. Thomson, A. J. Barth, F. J. Monson, G. Crichton, P. Laing. *Secretary and Treasurer*—J. Skottowe Webb, c/o National Insurance Company, Dunedin, New Zealand. *Recording Secretary*—W. Livingstone.

Foochow Camera Club.—(ESTABLISHED 1892.)—Meetings held at the Club Rooms. *President*—G. Siemssen. *Vice-President*—F. J. Rentzsch. *Hon. Treasurer*—H. W. Churchill. *Hon. Secretary*—J. Mencarini Foochow, China.

Gordon College Amateur Photographic Association.—(ESTABLISHED 1889.)—Meetings held at Gordon College, Geelong, Victoria. *President*—H. G. Roebuck. *Vice-Presidents*—D. H. Lord and R. Mockridge. *Committee*—Messrs. Thacker, McPhillimy, Price, Leitch, and Brinsmead. *Treasurer*—S. R. J. Mawson. *Secretary*—J. Hammerton, jun., Burngreave, 73 Little Ryrie Street, Geelong, Victoria.

Hamilton Association Camera Club.—(ESTABLISHED 1892.)—Meetings held at Hamilton Association Rooms, Public Library. *President*—J. M. Eastwood. *Vice-Presidents*—A. H. Baker and W. White. *Treasurer*—George Lees. *Secretary*—W. Henry Edwards, 168 Main Street, East, Hamilton, Ontario, Canada.

Hawke's Bay Camera Club.—(ESTABLISHED 1895.)—Meetings are held at the Club Room. *President*—Dr. J. H. E. Jarvis. *Vice-President*—A. A. Kennedy. *Committee*—Dr. A. Milne-Thomson, H. A. Banner, R. J. Duncan, S. E. Cooper, J. K. Newton, C. Saunders. *Secretary and Treasurer*—W. Beswick, Post Office.

Ipswich and West Moreton Amateur Photographic Society, Ipswich, Queensland—(ESTABLISHED 1893.)—Meetings on the second Wednesday of each month. *Hon. Secretary*—E. Bostock, Brisbane Street, Ipswich, Queensland, Australia.

Johannesburg Photographic Society.—Headquarters and Dark Rooms, Reliance Buildings, Kirk Street. Ordinary meetings, first and third Thursdays, commencing at eight p.m. *President*—J. Percy Fitzpatrick. *Vice-Presidents*—Dr. Kendal Franks and Rev. J. C. Harris. *Committee*—Dr. H. W. Bloomfield, H. Davies, W. Newby-Fraser, T. E. Goodall, Percy Greathead, H. R. Brownlie, J. Johnson Hoyle, J. Kuhlmann, J. H. L. Manisty, J. M. F. de Wit. *Hon. Secretary and Treasurer*—H. C. Haddon, 76 Market Street, Johannesburg.

Kimberley Camera Club.—(ESTABLISHED 1890.)—Meetings held at the Club Rooms. *President*—James Lawrence, M.L.A. *Chairman*—Montague Thane. *Vice-Chairman*—F. H. Hancox. *Council*—J. Childs, E. Goffe, L. Atkinson. *Secretary and Treasurer*—Charles Howie, P.O. Box 233, Kimberley, S.A.

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Maritzburg Camera Club.—Meetings held at Club Rooms, 4 Hardy's Chambers, Printing Office Street. *President*—S. S. Watkinson. *Vice-President*—T. C. Mitchell. *Committee*—The President, Vice-President, Treasurer, Secretary, and B. Nowell Musgrove, J. Fergusson, D. M. Eadie. *Judge*—John A. Hodges, London (Hon. Secretary to the Royal Photographic Society). *Treasurer*—A. M. Hudson. *Secretary*—O. R. Swete.

Montreal Camera Club.—(ORGANIZED 1890. INCORPORATED 1892.)—Place of Meeting, 4 Phillips Square, Montreal, Canada. *President*—George Sumner. *Vice-President*—A. W. Cole. *Committee*—Edward Barry, David R. Brown, G. W. Davis, Robert W. Elliott, N. N. Evans, F. T. Jennings, James J. Mason, Archibald McLean, C. K. Temple, R. Wilson, jun. *Secretary and Treasurer*—A. Clarence Lyman, 157 St. James Street, Montreal, Canada.

Nelson Camera Club, Nelson, New Zealand.—(ESTABLISHED 1888.)—Meetings are held at the Club Rooms, Hardy Street, Nelson, N.Z. *President*—C. Y. Fell. *Committee*—H. Brusewitz, H. V. Gully, F. W. Hamilton. *Treasurer*—F. Washbourne. *Secretary*—A. H. Patterson, Nelson, N.Z.

Northern Tasmanian Camera Club.—(ESTABLISHED 1889.)—Meetings held at the Albert Hall, Launceston, Tasmania. *President*—F. C. Birchall. *Vice-Presidents*—William Gibson, W. H. Twelvetrees, J. Sparrow. *Committee*—H. B. Brownrigg, C. Hart, A. H. Masters. *Secretary and Treasurer*—F. Styant Browne, 112 Brisbane Street, Launceston, Tasmania.

N.S.W. Lands Department Photographic Society, Sydney.—Meetings held on the last Thursday in each month. *Chairman*—J. R. Yorke. *Committee*—O. W. Ballhausen, E. T. Davis, M. V. Murphy, H. P. Rich, R. W. Vale. *Hon. Secretary and Treasurer*—William Hamilton, Lands Department, Sydney.

N.S.W. Railway and Tramway Camera Club.—(ESTABLISHED 1894.)—Meetings held at the Railway Institute, Sydney, N.S.W. *President*—H. McLachlan. *Vice-President*—H. Carruthers. *Committee*—F. Petterson, T. Marsh, C. S. Robins, A. J. Leslie. *Treasurer*—J. Paterson. *Secretary*—J. Scoular, Railway Institute, Sydney, N.S.W.

Perak Amateur Photographic Society.—(ESTABLISHED 1895.)—Meetings are held in Poverty Flat, Museum Road, Taiping. *President*—L. Wray, jun., M.I.E.E., F.Z.S. *Committee*—M. J. Wright, M.B., C.M., R. O. N. Anderson, A.M.I.C.E., F. Duberly, W. van Dart. *Hon. Secretary and Treasurer*—George Bain, Taiping, Perak.

Photographic Association of Canada.—(ESTABLISHED 1883.)—Place of Meeting, London, Ontario, Canada. *President*—H. S. Park (Toronto). *Vice-Presidents*—J. F. Jackson (Barrie) and W. Still (Orangeville) *Executive Committee*—H. S. Park, J. F. Jackson, W. Still, J. H. Ramsay, T. D. Hastings. *Treasurer*—J. H. Ramsay (Toronto). *Secretary*—Thomas D. Hastings, 169 Dundee Street, London, Ontario, Canada.

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Photographic Society of India.—(Established 1886.)—Meetings are held at 57 Park Street, Calcutta. *President*—T. A. Pope. *Vice-Presidents*—A. Flemming and N. Giannacopulo. *Committee*—L. P. D. Broughton, A. Caspersz, A. F. Cox, T. C. Downing, H. N. Harris, Maharaj Kumar, P. K. Tagore, F.R.P.S., A. W. Turner, F.R.P.S., E. M. Showers, T. H. Wilson. *Treasurer*—C. H. Coates. *Secretary*—W. R. Donogh, 57 Park Street, Calcutta.

Photographic Society of Japan.—(Established 1888.)—Meetings held at 1 Itchome Uchiyamashitacho, Tokyo. *President*—Prince M. Nijo. *Vice-President*—Vice-Count M. Nagaoka. *Committee*—Count U. Toda, Vice-Count Gnomoto, Baron Y. Hanabusa, Captain S. Toya, Dr. T. Kato, M. Nakajima, Count S. Omura, Vice-Count N. Okabe, Prof. Dr. D. Kikuchi, K. Ogawa, I. Tanaka, Dr. B. Marumo, R. Konishi, H. Shigyo, S. Kiga. *Treasurers*—S. Ohashi and K. Ikeda. *Secretaries*—Professor I. Ishikawa, Nandomachi, Tokyo, and K. Ogura, Minamiyenokimachi, Tokyo.

Photographic Society of New South Wales, Sydney.—(Established 1894.)—Meetings held at the School of Arts, Pitt Street. *Patron*—His Excellency Earl Beauchamp. *President*—His Honour Judge Docker. *Vice-Presidents*—Sir J. P. Abbott, K.C.M.G., Hon. F. T. Humphery, C. G. Alford, R. W. Kirk, E. T. Davis. *Committee*—H. T. Blake, F. H. Copeland, J. Heron, M. V. Murphy, L. Roever. *Treasurer*—J. M. Jago. *Secretary*—J. S. Stening, Box 829, G.P.O., Sydney, New South Wales.

Photographic Union of New South Wales, Sydney.—Meetings held on the first Thursday of each month. *Hon. Secretary*—Charles H. Kerry.

Queensland Amateur Photographic Society.—(Established 1887.)—Meetings are held at the *Courier* Building, Brisbane. *President*—Dr. John Thomson. *Vice-Presidents*—Dr. Wheeler, C. J. Pound, H. W. Mobsby. *Committee*—D. McTaggart, F. Nicholls, F. E. Davies, Dr. Love. *Treasurer*—J. L. Kinloch. *Secretary*—W. C. Voller, 88a Queen Street, Brisbane.

Singapore Amateur Photographic Society.—Meetings are held at 53 Hill Street, Singapore. *President*—E. J. Nanson. *Committee*—A. W. Bean and G. Brinkworth. *Treasurer*—F. M. Elliot. *Secretary*—E. F. Gros, Singapore.

South Australian Photographic Society.—(Established 1885.)—Meetings held at the Chamber of Manufactures, Adelaide. *President*—Andrew Scott, B.A. *Vice-Presidents*—R. F. Griffiths, and F. A. Joyner. *Committee*—The Executive Officers, C. L. Whitham, A. H. Kingsborough, A. W. Marshall. *Treasurer*—S. P. Bond. *Secretary*—J. Gazard, 111 King William Street, Adelaide. *Librarian and Assistant Secretary*—R. B. Adamson.

Southland Camera Club, Invercargill, New Zealand.—Meetings held on the third Monday in each month. *Hon. Secretary*—A. M. Macdonald, Esk Stores.

St. John Camera Club.—(ESTABLISHED 1893.)—Meetings held at 65 William Street, St. John, New Brunswick. *Secretary*—J. Kaye-Allison, P.O. Box 401, St. John, N.B. Canada.

Toronto Camera Club.—(ESTABLISHED 1887.)—Meetings held at the Forum Building, Yonge Street, Toronto, Ontario. *President*—Edmund E. King, M.D. *Vice-Presidents*—J. G. Ramsey and E. Stanger. *Committee*—W. H. Moss, G. R. Baker, W. Bohne, H. B. Lefroy, W. McTaggart, H. Hampshire. *Secretary and Treasurer*—John J. Woolnough, 32 Cottingham Street, Toronto.

Upper Canada College Camera Club.—(ESTABLISHED 1891.)—Meetings are held at Upper Canada College, Toronto, Ontario, Canada. *Secretary*—O. M. Biggar, 249 Simcoe Street, Toronto, Ontario, Canada.

Wanganui Camera Club, New Zealand.—(ESTABLISHED 1894.)—Meetings are held at the Wanganui Museum Buildings. *President*—A. Elliott. *Vice-Presidents*—Messrs. Babbage and S. Griffiths. *Committee*—Messrs. Anderson, Drew, Allison, Kersley, and President, Vice-Presidents, Secretary. *Hon. Secretary and Treasurer*—D. Meldrum, Wanganui.

Wellington Camera Club.—(ESTABLISHED 1892.)—Meets second Thursday in each month at Exchange Buildings, Wellington, New Zealand. *President*—A de Bathe Brandon. *Vice-Presidents*—A. C. Gifford, M.A., and J. McLellan. *Committee*—Thomas Pringle, G. W. Barltrop, M. C. Smith, W. McGregor Wright, A. B. Keyworth, M. Buckley Joyce. *Treasurer*—T. M. Hardy. *Secretary*—Joseph Alfred Heginbotham, Tea Gardens, Kilbirnie, Wellington, New Zealand.

West Australian Photographic Society, Perth.—(ESTABLISHED 1894.)—Meetings held on the third Wednesday in each month. Annual meeting in September. *Hon. Secretary*—A. R. L. Wright, Public Works Department, Perth.

Westland Camera Club, Hokitika, New Zealand.—*President*—James Park. *Hon. Secretary*—James King.

Working Men's College Photographic Club.—(ESTABLISHED 1891.)—Meetings are held at Latrobe Street, Melbourne, Victoria. *Patron*—His Excellency Lord Brassey. *President*—Prof. Kernot, M.A., M.E. *Vice-Presidents*—F. A. Campbell, C.E., T. C. Camm, A. J. Campbell. *Committee*—H. P. Bennett, T. J. Eastham, J. Cathie, H. Vanheems, T. Gray, J. Glover, H. Hampson, A. B. Sturtevant, L. Hart, F.R.M.S. *Treasurer*—E. C. Moore. *Secretary*—Arthur J. Kelph, Government Printing Office, Melbourne.

CONTINENTAL PHOTOGRAPHIC SOCIETIES.

Amateur Fotografen Vereeniging, Amsterdam.—Established September 1, 1887. Place of Meeting, Handboogstraat 2, Amsterdam. Ign. Bispinck, President. H. van der Match Spahler and A. P. Sluyterman, Committee. A. W. de Flines, Treasurer. J. P. Goedkoop, Plant Muidergracht, 37, Secretary.

Amateur Photographen Vereeniging 'Daguerre.'—Established 1894. G. P. Smith, President. J. H. J. Gorter, Treasurer. R. Roefsema Pzn. N. de Jager, Secretary.

Association Belge de Photographie.—Established 1874. Meetings are held at the Palais du Midi, Brussels. S.A.R. Monseigneur le Prince Albert de Belgique, Hon. President. Jos. Casier, President. Jos. Maes and Massange de Louvrex, Vice-Presidents. A. Canfyn, P. Clément, A. de Gryse, Th. Gilbert, Arm. Goderus, Edm. Jossart, Maurice Laloux, H. Peltzer, L. Nieuwland, Ch. Puttemans, L. Roland, A. Rutot, V. Selb, and Alb. Robert (Assistant Secretary and Librarian), Committee. A. Nyst, Treasurer. M. Vanderkindere, 97 Avenue Brugmann, Bruxelles, Secretary.

Association Nationale des Photographes Amateurs.—Fondée le 15 Mars, 1894, et autorisée par arrêté préfectoral du 22 Décembre, 1894. Place of Meeting, au domicile du Président, actuellement à Châteaugiron (Ille-et-Vilaine). Alfred Savary, President. M. Jousseaume, Vice-President. MM. Cosnard, Le Sage de la Haye, Marnelle, and Le Millier, Committee. Roul de la Hellière, au Château de Châteaugiron (Ille-et-Vilaine), Secretary and Treasurer.

Dansk Fotografisk Forening.—Established April 5, 1879. Place of Meeting, Copenhagen. F. C. L. Weller, President. P. Fristrup, Vice-President. C. U. Bauer, Treasurer. P. Schaumburg, Nórrebrogade 12, Copenhagen N., Secretary.

Deutsche Gesellschaft von Freunden der Photographie in Berlin.—Meldungen zum Beitritt für die Deutsche Gesellschaft von Freunden der Photographie nehmen die Mitglieder des Vorstandes entgegen und versenden dieselben auf Wunsch die 'Satzungen' der Gesellschaft. Näheres durch den Schriftführen Herrn Direktor Schultz-Hencke, Lette-Institut, Berlin S.W., Königgrätzer-strasse 90. Der Jahresbeitrag beträgt M.20,00. für Auswärtige jährlich M.14.

Deutscher Photographen Verein in Weimar.—Established December 29, 1876. Place of Meeting, Weimar. K. Schwier, President. E. Sonntag, Vice-President. F. Dyck, Paul Grundner, and D. Schultz-Henck, Committee. K. Schwier, Weimar, Secretary and Treasurer. C. Kesselhuth, Hildesheim, Registrar.

Dresdner Gesellschaft zur Förderung der Amateur-Photographie, Dresden.—Established 1897. Meetings held at the Vereinshaus, 17 Zinzendorfstrasse. E. Frohne, President. Hermann Schnauss, Vice-President. M. Herrmann, Treasurer. Hugo Quatz, Hon. Secretary. All letters, &c., should be addressed to the President (E. Frohne), 24 Schumannstrasse, Dresden.

Fachverein der Photographen zu Berlin.—Established December 1, 1893. Place of Meeting, Berlin, S. 14, Neue Ross-str., 3. Israr Brettschneider, President. Paul Tarksteit, Vice-President. Eduard Günther, Treasurer. R. Obizh and Eduard Günther, N.W. Lessingstrasse, 13, Secretaries.

Haarlemsche Amateur Fotografen Club.—Established 1891. Place of Meeting, Haarlem Societeit Vereeniging. F. J. M. Huijsser, President. C. G. H. Bakker, Treasurer. Maurits H. Binger, Zylweg, 55, Haarlem, Secretary.

Münchener Photographische Gesellschaft.—Established 1879. Place of Meeting, München. Adalbert Werner, President. Otto Wernhard, Treasurer. E. Kieser, Secretary. Address of Society, Deutsches Haus, Carlsplatz, München.

Nymeegsche Amateur Fotografen Vereeniging, M. L —Established 1893. Meetings held at the Café Suisse. Jacq. Kneppers, President. Van de Graaff, Treasurer. Baron van Hemert tot Dingshof, St. Annalaan, Nymegen (Holland), Secretary.

CONTINENTAL PHOTOGRAPHIC SOCIETIES—*Continued.*

PHOTO-CLUB DE PARIS.—Established 1888. Place of Meeting, 44 Rue des Mathurins, Paris. Maurice Bucquet, President. E. Mathieu, Vice-President. M. Binder, M. Brémard, A. Darnis, R. Demachy, P. Gers, P. Naudot, C. Puyo, A. Toutain, Committee. H. Guérin, Treasurer. Paul Bourgeois, 44 Rue des Mathurins, Paris, Secretary.

PHOTOGRAPHISCHE GESELLSCHAFT, HAMBURG, ALTONA.—Established November 4th, 1873. Place of Meeting, Hamburg Jungfernstieg, 40. F. A. Dahlström, President. Willy Wilcke, Vice-President. C. Färber, Treasurer. S Hamann, Secretary. Address of Society, F. A. Dahlström, Hamburg, Zeughausmarkt.

PHOTOGRAPHISCHE GESELLSCHAFT IN WIEN.—Established 1861. Ottomar Volkmer, President. Carl Angerer, Carl Böhm, Wilhelm Burger, Josef Maria Eder, Michael Frankenstein, Adalbert Franz, Josef Löwy, Wilhelm Müller, Perlmutter Max, Wilhelm Freiherr von Schwarz-Senborn, Robert Sieger, and Josef Ungar, Committee. Ludwig Schrank, Treasurer. Dr. Joseph Székely, Secretary.

PHOTOGRAPHISCHER VEREIN ZU BERLIN.—Established 1863. Place of Meeting, Berlin, Architecten Vereinshaus. Paul Grundner, President. T. Reichard, Vice-President. T. C. Schaarwächter, Dr. S. Steinschneider, Paul Schückert, Hpsm. u. Dr. Himly, Dr. A. Miethe, Dr. A. Hesekiel, and F. Cornand, Committee. E. Martini, Treasurer. Director Schultz-Hencke, Berlin, S.W. Königgratzerstrasse, P.V., Secretary.

SOCIÉTÉ FRANÇAISE DE PHOTOGRAPHIE.—Established 1854. M. Janssen, President. MM. A. Davanne (President), Ch. Bardy and Général Sebert (Vice-Presidents), Balagny, Gauthier-Villars, Gobert, Haincque de Saint-Senoch, Capitaine Houdaille, G. Rolland, Thouroude, Joseph Vallot, Léon Vidal, de Villecholle, Bordet (Librarian), E. Audra (Treasurer), S. Pector (Secretary), Albert Londe and Commandant Colson (Assistant Secretaries), Council.

SOCIÉTÉ GENEVOISE DE PHOTOGRAPHIE.—Established 1880. Meetings are held at Grand Mézel 1, Genève. Dr. Antoine Mazel, President, 1 Rue Centrale. Address all communications to the President.

SOCIÉTÉ NANTAISE DE PHOTOGRAPHIE.—Established 1881. M. du Hanlay, Lieut.-Colonel, President. M. Toublanc, Vice-President. Ch. Planté, H. Bureau, P. du Minehy, Committee. M. Tassain, Treasurer. Paul Crémant, Rue d'Alger, 13, Nantes, Secretary, and Pierre Courant, Assistant Secretary. Réunion le premier vendredi de chaque mois, au Cercle des Beaux-Arts.

SOCIÉTÉ PHOTOGRAPHIQUE PROFESSIONNELLE.—Established 1878. Place of Meeting, Place St. Gervais, 6, à Genève. E. Dovaz, President. Charles Racine, Vice-President. Louis Barral, Treasurer. Antoine Chevalley, Siège de la Société, Secretary.

SOCIÉTÉ VERSAILLAISE DE PHOTOGRAPHIE.—Established 1884. Séances de la Société les premiers Mardis de chaque mois à la Mairie à 8 heures et demie du soir. Maurice Bucquet, President. L. Ottenheim, Vice-President. Comité d'administration, Committee. M. Gavin, Treasurer. Jessé Curely, 20 Rue de Provence, Versailles, Secretary.

VEREIN ZUR FÖRDERUNG DER PHOTOGRAPHIE ZU BERLIN.—Established 1869. Prof. O. Raschdorff, President. Dr. E. Vogel and H. Haberlandt, Vice-Presidents. Oberleutnant Kiesling, Dr. Moehring, Paul Loescher, Dr. med. Kaiserling, Dr. L. Ellon, and W. Dieskau, Committee. Gustav Schmidt, Treasurer. Paul Hanneke, Berlin, W., Buelowstrasse, 99, Secretary.

VEREIN ZUR PFLEGE DER PHOTOGRAPHIE UND VERWANDTER KÜNSTE.—Established 1875. Place of Meeting, Frankfurt-a/Main. H. P. Hartmann, Honorary President. Prof. F. Schmidt, First President. H. Maas, Second President. W. Schräter, Librarian. C. Bättcher, Treasurer. Dr. E. W. Büchner, Registering Secretary. Th. Haake, Frankfurt-a/Main, Corresponding Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES.

Agassiz Association, Manhattan Chapter (*Photographic Section*), *New York.*—Established 1881. Meetings held at 141 East Fortieth Street, New York City. C. F. Groth, President. C. Kromm, Vice-President. C. F. Groth, R. Kitchelt, E. B. Miller, W. S. Miller, H. T. Rowley, H. Brennich, F. C. Fruhan, Miss M. Leeson, and Miss M. Hargrove, Committee. W. S. Miller, Treasurer. E. B. Miller, 141 East Fortieth Street, New York City Corresponding Secretary.

Akron Camera Club.—Meetings are held at residences of members on the second Tuesday of each month. Edward A. Terrass, President. Henry Canfield Vice-President. Frank Adams, Treasurer. Margaret Mitchell, 150 South Summit Street, Akron, Ohio, U.S.A., Secretary.

Albany Camera Club.—Established October 21, 1887. Meetings held at 72 Chapel Street, Albany, N.Y., U.S.A. General Robert Shaw Oliver, President. Charles W. Reynolds, Vice-President. The above officers, the Secretary and Treasurer, and George H. Russell, G. J. M. Goodwin, Howard P. Moore, Augustus Pruyn, L. H. Neuman, Charles H. Moore, S. C. Main, and Henry Popp, Committee. T. L. Carroll, Treasurer. Charles L. Palmer, 72 Chapel Street, Albany, N.Y., Secretary.

Amateur Photographic Association.—Established December 29, 1887. Meetings held at 916 Broad Street, Selma, Alabama, Dallas County. William S. Monk, President. S. A. Sexton, Vice-President. Miss Mary F. Keipp, Committee. Captain S. Orlando Trippe, Selma, Dallas County, Alabama, Secretary and Treasurer.

American Institute (*Photographical Section.*)—Established 1859. Meetings held at 19 and 21 West Forty-fourth Street, near Fifth Avenue, New York City, U.S.A. Oscar G. Mason, President. Robert A. B. Dayton, Vice-President. George H. Toop, Treasurer. Dr. J. W. Bartlett, 149 West Ninety-fourth Street, New York City, U.S.A., Secretary.

American Lantern Slide Interchange.—Established 1885. Meetings held at 361 Broadway, New York. The Interchange consists of a confederation of twenty-four Camera Clubs located in various parts of the United States, who exchange sets of 100 slides monthly with each other for exhibition. Annual meeting occurs November 15 of each year. Annual exchanges of slides with foreign societies are made. F. C. Beach (New York), W. H. Cheney (East Orange, New Jersey), W. H. Rau (Philadelphia, Pa.), John P. Zenner (Buffalo, N.Y.), and Herbert F. Smith (Syracuse, N.Y.), Board of Managers.

Atlantic City Photographic Society.—Established 1895. Meetings held at Atlantic City, N.J. Herbert N. Morse, President. Ferdinand Stodler, Vice-President. Leonard Dalger, Treasurer. Herbert Somers, 26 S. Indiana on Atlantic City, N.J., Secretary.

Bethlehem Photographic Society.—Established January, 1890. Meetings held at the residences of members. James E. Tatnall, President. Professor J. T. Hamilton, Vice-President. James E. Tatnall, Professor J. T. Hamilton, E. A. Rau, and R. P. Stout, Committee. E. A. Rau, Treasurer. R. P. Stout, 332 Market Street, Bethlehem, Pa., U.S.A, Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Birchwood-Beach Camera Club.—Established 1900. Meetings held at Harbert, Michigan. Wells B. Sizer, President. M. L. Sizer, Harbert, Michigan, Secretary.

Boston Camera Club.—Established 1881. Meetings are held at the Club Rooms, 50 Bromfield Street, Boston, Mass., U.S.A. Joseph Prince Loud, President. William O. Witherell, Charles H. Currier, and Frederick S. Anable, Vice-Presidents. Joseph Prince Loud, William O. Witherell, Charles H. Currier, Frederick S. Anable, Charles Hall Perry, Charles H. Chandler, G. F. Topliff, Charles Sprague, Edward R. Andrews, Francis H. Manning, William R. Richards, Percy E. Brown, and Owen A. Eames, Executive Committee. C. H. Currier, O. A. Eames. F. S. Annable, Committee on Rooms. W. O. Witherell, J. P. Loud, W. R. Richards, Committee on Entertainment. J. P. Loud, Charles Sprague. P. E. Brown, Committee on Exhibitions. F. S. Anable, Charles Sprague, F. H. Manning, Committee on New Members. W. O. Witherell, C. H. Chandler, O. A. Eames, Committee on Lantern Slides. G. Francis Topliff, Librarian. Charles H. Chandler, Treasurer. Charles Hall Perry, 50 Bromfield Street, Boston, Mass., U.S.A., Secretary.

Bridgeton Camera Society.—Established 1890. Meetings are held at the Bridgeton Cumb. Company, New Jersey. Henry W. Scull, President. Sidney H. Ogden, Vice-President. Charles C. Woodruff, Emerson B. Gamson, and Frank E. Riley, Committee. Hugh L. Reeves, Treasurer. James Boyd Patter, Bridgeton, N.J., Secretary.

Brockton Camera Club.—Established April, 1894. Meetings are held at Room 1, Smith Building, Center Street. Robert E. Brayton, President. A. L. Evans and Dr. J. S. Thorndike, Vice-Presidents. The Officers, and C. H. Lawrence, G. W. Laring, S. H. Eaton, E. F. Stacey, and E. W. Farwell, Committee. C. L. Perry, Treasurer. E. W. Farwell, Wyman Street, Brockton, Mass., U.S.A., Secretary.

Brooklyn Academy of Photography.—Incorporated 1887. Meetings held at 177 Montague Street, Brooklyn, U.S.A. William Arnold, President. F. M. Lawrence and A. N. Cook, Vice-Presidents. William Arnold, F. M. Lawrence, A. N. Cook, A. S. Ingram, H. E. Hayes, H. M. Valentine, A. N. Cook, W. C. Daggett, A. A. Goubert, H. B. Fullerton, Dr. S. B. Price, W. T. Wintringham, and R. T. Sheldon, Trustees. A. S. Ingram, Treasurer. H. M. Valentine, Recording Secretary. H. E. Hayes, 130 Montague Street, Brooklyn, U.S.A., Corresponding Secretary.

Brooklyn Institute of Arts and Sciences (*Department of Photography*).—Established 1887. Meetings held at 201 Montague Street, Brooklyn, New York. Charles H. Morse, President. William J. Bryant, Vice-President. Charles H. Morse (Chairman), J. W. Kent, W. J. Bryant, J. H. Norris, J. C. Oswald, William C. Peckham, F. A. Perret, A. C. Ruprecht, Mrs. C. H. Burdett, and Mrs. E. W. Maddren, Executive Committee. John H. Norris, Treasurer. A. C. Ruprecht, 379 Hancock Street, Brooklyn, New York, U.S.A., Secretary.

Buffalo Camera Club.—Established 1888. Meetings held at Franklin Street. John A. Stein, President. Harlow H. Boyce and H. Wilson Saunders, Vice-Presidents. John A. Stein, Harlow H. Boyce, H. Wilson Saunders, William G. Houck, John P. Zenner, Conrad L. Baer, Philip J. Knapp, Henry H. Gurnther, C. R. Knapp, James Savage, Louis F. Jansen, and Louis B. Hart. Conrad L. Baer, 1 Genesee Street, Buffalo, N.Y., Secretary and Treasurer.

American Photographic Societies—*Continued.*

California Camera Club.—Incorporated April 5, 1890. Meetings held at the Academy of Sciences Building, San Francisco, California, U.S.A. James W. Erwin, President. E. J. Dollard and W. B. Webster, Vice-Presidents. The Officers, and W. J. Street, J. W. Finigan, J. J. B. Argenti, and H. B. Madison, Directors. M. A. Greenlaw, Librarian. E. G. Eisen, Treasurer. H. B. Hosmer, 819 Market Street, Room 58, San Francisco, California, U.S.A., Secretary. C. A. Lee, Corresponding Secretary.

Camera Club, New York.—Established May 7, 1896. Meetings held at 3 West Twenty-ninth Street, New York City, U.S.A. William D. Murphy, President. Alfred Stieglitz, Vice-President. William P. Agnew (Chairman), R. L. Bracklow, E. T. Birdsall, and G. Lorillard Ronalds, House Committee. H. B. Reid (Chairman), Dr. J. T. Vredenburgh, and Henry H. Man, Meetings Committee. Alfred Stieglitz (Chairman), Joseph T. Keiley, Dallett Fuguet, W. F. Hapgood, and Joseph Obermeyer, Publications Committee. Charles I. Berg (Chairman), A. Walpole Craigie, and Joseph T. Keiley, Prints Committee. Frank M. Hale (Chairman), Dr. Charles W. Stevens, Arthur Scott, and J. F. Strauss, Lantern-slide Committee. L. B. Schram (Chairman), C. C. Roumage, and Henry H. Man, Auditing Committee. John Aspinwall (Chairman), Dr. J. H. Stebbins, Jun., and Charles E. Manierre, Scientific Research Committee. Charles E. Manierre (Chairman), J. F. Strauss, and A. Walpole Craigie, Admission Committee. Louis B. Schram, Charles I. Berg, John Aspinwall, William J. Cassard, John Beeby, and William P. Agnew, Trustees. John Beeby, Librarian. William E. Wilmerding, Treasurer. Harry B. Reid, Secretary.

Camera Club of Mount Vernon.—Established 1895. Meetings are held at Studio of W. F. Slaight, Fourth Avenue, Mount Vernon, New York, U.S.A. Miss Mary E. Jennings, Secretary.

Camera Club of the University of Nebraska.—Established 1892. Meetings held at the Chemical Laboratory of the University of Nebraska, corner of Twelfth and R Streets, Lincoln, Neb., U.S.A. Miss Adaline Quaintance, P. O. Box 675, Lincoln, Neb., U.S.A., Secretary and Treasurer.

Camera Club of the University of Pennsylvania.—Established 1889. Meetings held at the College Hall, University of Pennsylvania, Thirty-sixth Street and Woodland Avenue, Philadelphia, Pa. Chas. R. Hinchman, 3655 Chestnut Street, Philadelphia, Pa., U.S.A., Secretary.

Camerads.—Established April 24, 1890. George K. Parsell, President. J. A. Blish, Vice-President. J. Arthur Blish, William Macom, D.D.S., George A. Veightmann, Council. Harvey Iredell, D.D.S., Lock Box 34, New Brunswick, N.J., Secretary and Treasurer.

Capital Camera Club.—Established May, 1891. Meetings held at 1010 F Street. Wallace C. Babcock, President. Dr. W. P. Herbst, Vice-President. W. C. Babcock, Dr. W. P. Herbst, Dr. W. E. Dieffenderfer, W. F. Peabody, E. B. Thompson, C. E. Fairman, E. M. Tolman, R. E. Logan, H. P. Simpson, E. J. Daw, J. M. Little, J. W. L. Dillman, and Miss K. S. Curry, Board of Directors. Dr. W. E. Dieffenderfer, Treasurer. W. F. Peabody, 918 L Street, or 1010 F Street, Secretary.

Central Camera Club, Brooklyn Y.M.C.A.—Established January 1, 1888. Meetings held at 502 Fulton Street, Brooklyn, N.Y. William H. Lowery, President. James P. Allen, Vice-President. Charles Kuhn, Treasurer. Rud. Gebeth, 19 Hudson Ave., Brooklyn, N.Y., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Chautauqua Photographic Exchange Club.—Established 1888. C. M. Fitzgerald (Georgetown, California), President. Miss C. L. Pierce, Elmhurst, Riverside, Conn., U.S.A., Secretary and Treasurer.

Chicago Society of Amateur Photographers.—Established 1886. Meetings held at the Art Institute, Chicago. T. George Hislop, President. E. M. Murray, Vice-President. T. George Hislop, E. M. Murray, George H. Kittoe, Charles C. Cook, Marshall Wait, Dr. G. Gordon Burdick, Winfred S. Basley, Frederick K. Laurence, and E. W. Thomas, Board of Directors. George H. Kittoe, Treasurer. Charles C. Cook, The Art Institute, Secretary.

Cleveland (Ohio) Camera Club.—Established January 25, 1887. Meetings held at 5 Euclid Avenue on the first and third Tuesday evenings of each month at Eight p.m. The Annual Meeting is held on the first Tuesday evening in January, unless that Tuesday is the 1st of January, in which case it is deferred until the third Tuesday. William Ogler, President. Charles Potter, Vice-President. William Dorn, Treasurer. R. Dayton, M.D., 1202 Willson Avenue, Cleveland, Ohio, U.S.A., Secretary.

Colorado Camera Club Association.—Established October, 1891. Meetings held at 329 Sixteenth Street, Denver, Colorado, U.S.A. W. H. Jackson, President. Major William Cooke Daniels, Vice-President. W. H. Jackson, Robert J. Coleman, Major William Cooke Daniels, H. D. Smith, A. B. Daniels, A. D. Gilleland, and S. C. McCurdy, Board of Directors. H. D. Smith, Treasurer. A. D. Gilleland, 329 Sixteenth Street, Denver, Col. U.S.A., Secretary.

Columbia College (N. Y.) Amateur Photographic Society.—Established 1886. Meetings at Columbia College twice a month. Henry R. Taylor President. Dwight Taylor, Treasurer. H. M. Brookfield, Secretary.

Columbian College (Washington, D. C.) Camera Club.—Established 1888. Ordinary Meetings at Columbian College, Washington, D. C., every Wednesday afternoon. Allan J. Houghton, President. Edwin W. Ashford, Vice-President. W. B. Asmussen, Librarian. A. J. Houghton, Treasurer. Charles P. Spooner Secretary.

Columbia Photographic Society.—Organized December 7, 1889. Incorporated June 29, 1894. Meetings are held at 1811 N. Broad Street. Dr. G. J. R. Miller, President. P. A. Mitchell, First Vice-President. Frank E Gantley, Second Vice-President. William W. Chambers, John N. Reeve N. E. Roedel, J. Harry Pepper, J. Wesley Allison, E. Morris Scattergood A. R. Heinitsch, and Louis Renner, Board of Directors. John S. Newman Treasurer. John Curtis, Sen., 1811 N. Broad Street, Secretary.

Columbus (Ohio) Camera Club.—Established October 6, 1884. Rooms, Y.M.C.A. Building. Regular Meetings, third Thursday of each month except July and August at half-past Seven p.m. Annual Meeting, third Thursday of December. John Field, President. C. H. Doty, Vice-President. C. S. Bradley, Treasurer. W. B. Kimball, 32 East Spring Street, Columbus, Ohio, U.S.A., Secretary.

Corliss Art and Camera Club.—Established May 1, 1896. Meetings held at the State Street Corliss Memorial Building. J. S. McDaid, President. O. P. Gould and J. H. Wheeler, Vice-Presidents. Edgar F. Noyes, Treasurer. Miss A. B. Brown, Newburyport, Mass., c/o N. N. Jones, Secretary.

Cortland Camera Club.—Established 1895. Meetings held at Y.M.C.A. Rooms. L. M. Alexander, Lock Box 213, Cortland, N.Y., U.S.A., Secretary and Treasurer.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Delaware Camera Club.—Established 1891. Headquarters in its Club Rooms in the Equitable Building, Wilmington, Delaware. Regular Meetings are held on the first Thursday of each month. John M. Rogers, President. Miss Rachel S. Howland and Geo. A. Elliott, Vice-Presidents. John C. Phillips, 803 Franklin Street, Wilmington, Del., U.S.A., Secretary.

Detroit Camera Club.—Established February 17, 1897. Meetings held at 106 Miami Avenue. E. W. Sprague, President. A. D. Noble, jun., Vice-President. E. D. Roberts, O'Brien Atkinson, R. A. Field, J. E. Scott, F. B. Wood, A. D. Noble, W. S. Thomas, E. W. Sprague, W. E. Winckler, and Miss Davison, Executive Committee. W. E. Winckler, 106 Miami Avenue, Secretary and Treasurer.

Detroit Lantern Club.—Established January, 1891. Meetings held at the Museum of Art, Hastings Street and Jefferson Avenue, Detroit, Mich. Frank E. Kirby, President. A. D. Noble, jun., Director. D. Farrand Henry, 52 Woodward Avenue, Detroit, Mich., U.S.A., Secretary and Treasurer.

Elizabeth Camera Club.—Established 1893. Meetings held at 96 Broad Street. Jas. A. Knowles, President. A. P. Campbell, Vice-President. Dr. E. D. Frost, T. F. McCarty, J. G. Green, John Ball, E. W. Smith, A. P. Campbell, and A. N. Lakens, Committee. James A. Knowles, Treasurer John Ball, 96 Broad Street, Elizabeth, N.J., U.S.A., Secretary.

Frankford Camera Club of Philadelphia.—Established October, 1888. Meetings are held at Knight's Industrial and Beneficial Institute, Frankford, Philadelphia. B. Antrim Haldeman, President. John B. Lomax, Vice-President. Benjamin S. Thorp, Harry E. Crankshaw, John B. Lomax, Miss M. C. Shallcross, Miss M. R. Rover, and, *ex officio*, the President and Secretary, Committee. Harry E. Crankshaw, Treasurer. John M. Justice, 5016 Penn Street, Frankford, Philadelphia, Pa., U.S.A., Secretary.

Hartford Scientific Society (Photographic Section).—Established 1885. Meetings held at 65 Pratt Street, Hartford, Conn., U.S.A. C. R. Nason, Chairman. Louis W. H. Gradisky, 80½ Ann Street, Hartford, Conn., U.S.A., Secretary and Treasurer.

Harvard Camera Club.—Established 1889. Headquarters, Harvard University, Cambridge, Mass. Annual meeting, June. Meetings monthly. Vernon Maunse, President. C. P. M. Rumford, Vice-President. Percy Emerson Brown, 11 Weld Hall, Cambridge, Mass., U.S.A., Secretary and Treasurer.

Haverhill Camera Club.—Established February 15, 1898. Meetings held at the Rooms Nos. 44 and 45 Daggett Building, Haverhill, Mass. Elbridge H. Lufkin, President. Arthur S. Bailey, Vice-President. Charles W. Glines, George J. Kaula, and Officers, Committee. Alfred A. Ordway, August Spuhler, and E. H. Lufkin, Exhibition Committee. Alfred E. Collins, Haverhill, Mass., U.S.A., c/o Haverhill Savings Bank, Secretary and Treasurer.

Hoboken Camera Club.—Established March 22, 1889. The Regular Meetings of the Club take place the first Tuesday of each month. The Board of Governors meet the third Friday of each month. The Annual Meeting of the Club takes place the first Tuesday in March, when the election of officers takes place for the ensuing year. All Meetings are held at 1036 Park Avenue, Hoboken, N.J. A. J. Thomas, President. C. Sudhaus, Vice-President. Three Trustees (W. Schrader, A. Beyer, and E. E. Wooley), all the Officers of the Club, the House Committee (F. A. Muench), and the Entertainment Committee, Board of Governors. William Allen, Custodian. H. J. Kultenbach, Treasurer. A. L. Smith, 1045 Bloomfield Street, Hoboken, N.J., U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

International Photographic Print Exchange.—Established May, 1893. A Postal Photographic Club of twenty members. Walter Sprange, Beach Bluff, Mass., U.S.A., Secretary.

Irvington (N.J.) Art and Camera Club.—Established 1892. Meetings are held at Springfield and Union Avenues, Irvington, N.J., U.S.A. Edwin D. Harrison, President. F. H. Morrell, Vice-President. James Peckwell, jun., Treasurer. Melton Tompkins, Secretary.

Lancaster Camera Club.—Established May 15, 1895. Meetings held at Rooms, *Morning News* Building, Penn Square. William S. Gleim, President. W. A. Heitshu, Vice-President. Charles A. Sauber, Secretary and Treasurer. F. A. Demuth, 114 East King Street, Lancaster, Pa., U.S.A., Corresponding Secretary.

Louisville Camera Club.—Established 1888. Meetings held at North-east corner of Fourth Avenue and Jefferson Street, Louisville, Ky. R. L. Stevens, 1100 West Main Street, Louisville, Ky., U.S.A., Secretary.

Lowell Camera Club.—Incorporated 1892. Meetings held at Runels Building. Paul Butler, President. W. P. Atwood and F. T. Walsh, Vice-Presidents. Officers and Charles Runels, Lucius A. Derby, and A. H. Sanborn, Committee. Fay H. Martin, Treasurer. George A. Nelson, 305 Summer Street, Lowell, Mass., Secretary.

Lynn Camera Club.—Established January 1, 1888. Incorporated December 20, 1889. Regular Meetings, first Tuesday in each month. Annual Meeting, first Tuesday in January. All Meetings held at the Club House, 42 Broad Street. William H. Drew, President. J. N. Smith, Vice-President. W. H. Drew, J. N. Smith, J. W. Gibboney, A. J. Purinton, E. F. Bacheller, A. H. Carsley, W. B. Gifford, and W. A. Pevear, Committee. E. F. Bacheller, Treasurer. C. A. Lawrence, Club House, 42 Broad Street, Lynn, Mass., U.S.A., Secretary.

Mattapan Camera Club.—Established May, 1890. Meetings held at the private residences of members. John A. Locklin, President. Walter Hertzberg, Vice-President and Treasurer. Erdmann Sonnenbrodt, Mattapan, Mass., U.S.A., Secretary.

Memphis Camera Club.—Established 1893. Meetings held at the Y.M.C.A. Buildings. S. J. Latta, President. A. Wardle, Vice-President. S. J. Latta, A. Wardle, Geo. O. Friedel, M. Stewart, E. I. Pinnel, Directors. Geo. O. Friedel, 165 Gayoso Street. Memphis, Tenn., U.S.A., Secretary and Treasurer.

Minneapolis Camera Club.—Incorporated 1892. Meetings held at 309 Nicollet Avenue. H. E. Murdock, President. W. H. McMullen, Vice-President. L. J. Skinner, Oscar Tucker, George W. Beach, E. J. Kimball, C. A. McCollorn, M.D., A. S. Williams, and the four Officers named, Board of Directors. J. F. Schlimme, Treasurer. C. J. Hibbard, 309 Nicollet Avenue, Minneapolis, Mi [illegible]. Secretary.

Mystic Camera Club.—Established 1889. Meetings held at 2 Ashland Street, Medford, Mass., U.S.A. John F. Wade, President. L. E. Shattuck, Vice-President. J. F. Wade, L. E. Shattuck, Everett Scammon, Charles A. Clark, Will C. Eddy, E. B. Dennison, and J. F. W. Ames, Executive Board. Will C. Eddy, 16 Foster Road, Medford, Mass., U.S.A., Secretary.

Newark (Delaware) Camera Club.—Established 1893. Meetings held at Newark, Delaware. Professor F. D. Chester, President. G. H. Powell, Vice-President. F. William Curtis, Newark, Delaware, U.S.A., Secretary and Treasurer.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

New Britain Camera Club.—Established 1892. Headquarters, 210 Main Street. Annual meeting, January. Meetings, second and fourth Tuesdays in each month. E. F. Porter, President. G. A. Reckard, Vice-President. F. W. Wood, 273 Main Street, New Britain, Conn., U.S.A., Secretary and Treasurer.

New England Lantern Slide Exchange.—Established 1890. Will. C. Eddy, 88 Marshall Street, Medford, Mass., U.S.A., Secretary.

New Orleans Camera Club.—Established December 17, 1886. Meetings are held at 712 Union Street, New Orleans, La. Hon. Bernard C. Shields, President. W. Gowland, Vice-President. William Grimshaw, Treasurer. M. V. Haulard, 1729 Bienville Avenue, New Orleans, La., U.S.A., Secretary.

Newton Camera Club.—Established 1893. Meetings held at the Club House, Brookside Avenue, Newtonville, Mass., U.S.A. F. O. Stanley, President. E. E. Snyder, Vice-President. Austin S. Kilburn, West Newton, Mass., U.S.A., Secretary.

New York Camera Club.—Established 1888. Meetings are held at 314 Fifth Avenue, New York. Samuel W. Bridgham, President. Franklin Harper, Vice-President. Robert J. Devlin, Treasurer. Chas. W. Stevens, M.D., 33 West Thirty-third Street, New York City, U.S.A., Secretary.

Norwalk Camera Club.—Established November 3, 1897. Mrs. W. V. Prinliss Dingan, President. Mr. H. W. Van Sciver, Vice-President. Harry Hall Finch, Bayview Avenue, So. Norwalk, Conn., U.S.A., Secretary and Treasurer.

Old Colony (Rockland, Mass.) Camera Club.—Established February 1, 1890. Meetings held at Arnold Building, Liberty Street. David Smith, President. Emery H. Jenkins, Vice-President and Treasurer. David Smith, Rockland, Mass., U.S.A., Secretary.

Omaha Camera Club.—Established 1894. Meetings held at 1312 Farnam Street, Omaha, Neb. W. Durnall, 1312 Farnham Street, Omaha, Neb., U.S.A., Secretary.

Oneida Camera Club.—Established March 1, 1894. Meetings are held at the Club Rooms, Post-office Building, Oneida, N.Y. B. S. Teale, President. George R. Hanson, Vice-President. Jacob Standt, Wesley Fisher, and C. M. Kingsbury, Committee. Albert Dygert, Treasurer. C. R. Baker, P.O. Block, Oneida, N.Y., U.S.A., Secretary.

Orange (N.J.) Camera Club.—Organized March 21, 1892. Meetings held on 5th and 20th of each month. F. H. Gould, President. D. S. Plumb, Vice-President. W. H. Cheney, Chairman of Lantern Slide Committee. E. J. Apgar, Chairman of House Committee. F. L. Fieger, Chairman of Membership Committee. T. J. Preston, jun., Chairman of Print Committee. Hermann Joerns, Chairman of Finance Committee. E. S. Butterfield, Treasurer. W. H. Mason, Secretary. Executive Committee composed of above nine persons.

Oregon Camera Club.—Established January 14, 1895. Meetings held at the Club Rooms, Oregonian Building, Portland, Oregon. Will H. Walker, President. F. C. Cover, Vice-President. Will H. Walker, F. C. Cover, Milton P. Goldsmith, F. A. French, and Hugo B. Goldsmith, Executive Committee. F. A. French, Treasurer. Milton P. Goldsmith, P.O. Box 93, Portland, Oregon, U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Paterson Camera Club.—Established 1893. Meetings are held at 9 Lake Street. C. M. Giles, President. H. W. Gledhill, Vice-President. Wm. M. Moore, Treasurer. Chas. D. Cooke, Cooke Locomotive Works, Paterson, N.J., U.S.A., Secretary.

Photographers' Association of America.—Established 1880. Place of meeting in 1901, Detroit, Michigan. E. B. Core, President. D. D. Spellman, First Vice-President. Henry Klein, Second Vice-President. The combined Officers form the Executive Board. F. R. Barrows, Treasurer. J. George Nussbaumer, 500 Main Street, Buffalo, New York, Secretary.

Photographers' Association of Iowa.—Established 1889. Meetings held at Des Moines, Iowa. G. S. Coman, President. E. S. Frey, First Vice-President. W. H. Jacobs, Second Vice-President. Theo. A. Brown, Treasurer. J. R. Hall, Monroe, Iowa, U.S.A., Secretary.

Photographers' Association of Ohio.—Office of Executive Committee, Hamilton, Ohio. A. L. Bowersox, President. George H. Barnum, Springfield, Ohio, U.S.A., Secretary.

Photographers' Association, State of Missouri.—Established 1894. Meetings at St. Louis, Mo., 1899. George W. Curtiss, President. F. Tenby, jun., and C. Stewart, Vice-Presidents. Miss Belle Johnson, Treasurer. Fred Hammer, jun., 1545 Broadway, St. Louis, Mo., Secretary.

Photographic Society of Philadelphia.—Established November, 1862. Meetings held at 10 South Eighteenth Street, Philadelphia, Pa., U.S.A. Robert S. Redfield, President. George Vaux, jun., and Walter P. Stokes, Vice-Presidents. The Officers and Prescott Adamson, John G. Bullock, George D. Firman, F. William Geisse, William N. Jennings, Caspar W. Miller, M.D., C. R. Pancoast, William H. Rau, William H. Roberts, Benjamin Sharp, M.D., Henry Troth, and William S. Vaux, jun., Directors. Anthony W. Robinson, Treasurer. Edmund Stirling, 4517 Kingsessing Avenue, Philadelphia, Pa., Secretary.

Photographic Club of Baltimore City.—Founded 1886. Meetings held at corner of Madison and Eutaw Streets, Baltimore City, Md., U.S.A. Frank T. Slothower, M.D., President. Percy M. Reese, Vice-President. Jordon Stabler, I. T. Norrlis, F. W. McAllister, F. T. Slothower, Percy. M. Reese, E. M. Barker, and J. P. Bigham, Committee. Enoch M. Barker, Treasurer. J. Plumer Bigham, corner of Madison and Eutaw Streets, Baltimore, Md., U.S.A., Secretary.

Pittsburg Amateur Photographers' Society.—Organized 1885. Incorporated 1896. Meetings held at the Carnegie Library, Pittsburg, Pa., U.S.A. E. E. Keller, President. H. L. Christy, Vice-President. E. E. Keller, H. L. Christy, Mrs. S. A. Ammon, W. J. Boston, F. E. Gaither, F. T. Aschman, A. B. McVay, W. J. Hunker, and J. H. Hunter, Board of Trustees. W. J. Hunker, Treasurer. J. H. Hunter, 520 Greene Street, Pittsburg, Pa., U.S.A., Secretary.

Pittsfield Camera Club.—Established February 1, 1892. Meetings held at 768 North Street. J. F. Middleton, President. J. D. Roscoe, Vice-President. J. F. Middleton, J. D. Roscoe, J. E. Colton, J. H. Musgrove, A. N. French, C. G. Tompkins, and S. S. Stowell, Executive Committee. J. H. Musgrove, Treasurer. Jos. E. Colton, 768 North Street, Pittsfield, Mass., U.S.A., Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Plainfield Camera Club.—Established 1889. Meetings held at the Club Gallery, Babcock Building. Walter H. Freeman, President. J. Hervey Doane, Vice-President. W. H. Freeman, Hervey Doane, H. H. Coward, Harold Serrell, and George H. Fountain, Board of Directors. H. H. Coward, City National Bank, Plainfield, N.J., Secretary and Treasurer.

Portland (Maine) Camera Club.—Established 1891. Meetings held at the Club Rooms. Stanley P. Warren, M.D., President. C. T. Whipple, Treasurer. Frederick Fox, jun., 66 Union Street, Portland, Maine, U.S.A., Secretary.

Postal Photographic Club.—Established April, 1885. Albert J. Le Breton (Washington, D.C.), President. F. O. Congdon, 120 Broadway, New York (Headquarters), Secretary and Treasurer.

Providence Camera Club.—Organized 1883. Incorporated 1889. Meetings held at 174 Weybosset Street, Providence, R.I. Christopher M. Lee, President. W. Penn Mather, Vice-President. O. L. Holt, Franklin W. Cummings, Frederick E. Brown, Mrs. E. E. Hill, John W. Auty, Arthur Winsor, R. Clyde L'Amoureux, and D. Howard Thornton, Executive Committee. Edmund A. Darling, Treasurer. David Bangs Pike, Court House, Providence, R.I., Corresponding Secretary.

Putnam (Conn.) Camera Club.—Established January, 1888. Headquarters at its Club Rooms, Putnam, Connecticut. Regular Meetings are held on the first Friday in each month. The Annual Field Day occurs on the first Wednesday in June. George E. Dresser, President. Edward F. Whitmore, Treasurer. Eric H. Johnson, Putnam, Connecticut, U.S.A., Secretary.

Rutland Camera Club.—Established October, 1893. Meetings held at 149 South Main Street, Rutland, Vt. Cornele G. Ross, President. Cornele G. Ross, N. S. Marshall, and V. F. Worcester, Committee. V. F. Worcester, 149 South Main Street, Rutland Vt., Secretary and Treasurer.

Sacramento Camera Club.—Established 1895. Meetings held at the Club Rooms, 504 J Street. Ferdinand Kobler, President. S. B. Nourse, Vice-President. Ferdinand Kohler, S. B. Nourse, W. G. Woods, R. P. Burr, R. B. Prideaux, W. E. Cogswell, and J. J. Gormley, Directors. R. P. Burr, Treasurer. W. G. Woods, 420 J Street, Sacramento, California, Secretary.

San Diego Camera Club.—Established May 12, 1900. Meetings held at the Opera House Building. Ford A. Carpenter, President. F. W. Kelsey, Vice-President. George W. Anderson (Entertainment), and Arthur Small (Outing Captain), Committee. J. E. Slocum, Treasurer. E. L. Rector, P.O. Box 138, Secretary.

Schuylkill Camera Club.—Established July 5, 1889. Meetings are held at the Q.O.O.F. Hall, 103 Market Street, Pottsville, Pa. A. W. Sheafer, President. Miss Elena Roads, Vice-President. The Officers are the Committee. W. L. Sheafer, Treasurer. B. S. Simonds, 1432 West Norwegian Street, Pottsville, Pa., Secretary.

Society of Amateur Photographers of New York.—Established March 10, 1884. Meetings are held at 113 West Thirty-eighth Street. C. C. Roumage, President. Dr. J. H. Stebbins, jun., Vice-President. Dr. J. T. Nagle, E. T. Birdsall, Albert Stetson, Louis T. Brush, C. W. Canfield, Harry Coutant, G. F. Basset, and Frank M. Hale, Board of Directors. W. E. Johnson, Treasurer. R. L. Bracklow, Recording Secretary. T. J. Burton, 113 West Thirty-eighth Street, New York City, U.S.A., Corresponding Secretary.

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Springfield Camera Club.—Established October, 1880. Meetings held at the Y.M.C.A. Building, corner of State and Dwight Streets, Springfield, Mass., U.S.A. Bion D. Wheeler, President. W. P. Draper, J. W. Knight, E. L. Pease, and John W. Roberts, Executive Committee. Eugene L. Pease, 71 James Street, Springfield, Mass., U.S.A., Secretary.

Stevens (Hoboken, N. J.) Photographic Society.—Established 1880. Meetings held at the Stevens Institute, Hoboken, N.J. R. P. Jennings, President. — Ode, Vice-President. L. M. De Azeveda and Jos. Stehlin, Committee. Charles L. Wachter, Treasurer. E. C. Voorhees, Stevens Institute, Hoboken N.J., U.S.A., Secretary

St. Louis Camera Club.—Established 1885. Meetings held at 911 North Vandeventer Avenue. Walter H. Wilcox, President. M. T. Corwin, Vice-President. Charles M. Alexander, Chairman of the Lantern Slide Committee. H. B. Alexander, 4028 Westminster Place, St. Louis Mo., U.S.A. Secretary and Treasurer.

St. Louis Photographic Society.—Established December 1895. Meetings held in Y.M.C.A. Building, Grand and Franklin Avenue. Robert E. M. Bain, President. John B. Holman, Vice-President. Charles M. Alexander, 4028 Westminster Place, St. Louis, Missouri, U.S.A., Secretary and Treasurer.

St. Paul Camera Club.—Established April 19, 1899. Meetings held at third floor, 48 East Fourth Street, St. Paul, Minn. William E. Johnson, President. W. J. Sonnen, Vice-President. The Officers, and W. A. Gates, F. H. Lloyd, and E. A. Drew, Trustees. H. A. Clifford, Treasurer. E. N. Easton, 48 East Fourth Street, St. Paul, Minn., U.S.A., Secretary.

Sunny Side Camera Club.—Established October 10, 1891. Meetings held at 5900 South Broadway, St. Louis, Mo. Berthold W. B. Blumenthal, President. Edmund Broch, Vice-President. B. W. B. Blumenthal, William A. Britchner, Charles Hendemuth, and Algernon Blumenthal, Committee. William A. Britchner, 1235 South Broadway, St. Louis, Mo., U.S.A., Secretary and Treasurer.

Syracuse Camera Club.—Established 1886. Meetings held at 302 to 312 University Buildings, Syracuse, N.Y., U.S.A. Louis S. Morgan, President. J. I. H. Wright, Vice-President. L. S. Morgan, J. I. H. Wright, Dan H. Sweet, J. E. Bierhardt, H. T. Beach, H. F. Smith, H. D. Barto, and E. M. Pierce, Board of Directors. J. E. Bierhardt, Treasurer. Dan H. Sweet, 246 West Railroad Street, Syracuse, N.Y., U.S.A., Secretary.

Tech Camera Club.—Established September, 1889. Meetings, bi-monthly, at half-past seven p.m., in the Boynton Hall of the Polytechnic Institute, Worcester, Mass. Dark room and Printing room also at Boynton Hall. The purpose of the Meetings is to discuss photographic subjects and, as far as possible, to diffuse a knowledge of the science and art among the members of the Institute. The Executive Committee transact all business connected with the Club. H. J. Fuller, President. A. J. Smith, Vice-President. J. W. Higgins, 228 West Street, Worcester, Mass., U.S.A., Treasurer and Secretary.

Technology Photographic Society.—Established 1893. Meetings are held at Massachusetts Institute of Technology, Boyleston Street, Boston, Mass. Herman A. Poppenhusen, President. Welles M. Partridge, Vice-President. President, Vice-President, Secretary, Treasurer, and Frederick Kleinschmidt, Committee. Arthur C. Lawley, Treasurer. E. Johnson Loring, Mass. Inst. Tech., Boston, Mass., U.S.A., Secretary

AMERICAN PHOTOGRAPHIC SOCIETIES—*Continued.*

Topeka Camera Club.—Established September 5, 1894. Meetings held at members' homes. F. M. Tuckerman, President. Ralph H. Gaw, Vice-President. W. E. Culver, Treasurer. F. M. Tuckerman, 34 Santa Fé Building, Topeka, Kansas, Secretary.

Trenton Photographic Society.—Established January, 1898. Meetings are held at Room 11, Scott Building, 132 East State Street, Trenton, N.J. Samuel S. Webber, President. Dr. James I. Woolverton, Vice-President. All Officers and four members, Trustees. Harry V. Holden, Treasurer. Grant Castner, 51 Bayard Street, Trenton, N.J., U.S.A., Secretary.

Valley Camera Club.—Established 1896. Meetings held at Phenix, Rhode Island, U.S.A. Ward E. Smith, President. Ward E. Smith, Frederick J. Hoxie, Andrew Yorston, J. Bancroft Lawton, and Everet Nichols. Executive Committee. Frederick J. Hoxie, Treasurer. J. Bancroft Lawton, Box 43, Phenix, R.I., U.S.A., Secretary.

Waterbury Photographic Society.—Established 1888. Meetings are held at Platt's Block, Waterbury, Conn. Oscar A. Ziglatzki, President. George F. Hodges, Vice-President. Henry T. Stedman, George H. Ward, and George Husker, Executive Committee. Henry T. Stedman, Treasurer. Hollyday Emery, Waterbury, Conn., U.S.A., Secretary.

Watertown (N. Y.) Camera Club.—Meetings held at 4 Paddock Arcade Watertown, N.Y. A. R. Wilson, President. George Mowe, Treasurer. C. A. Wilson, 2½ Public Square, Watertown, N.Y., U.S.A., Secretary.

Worcester Camera Club.—Re-established 1892. Meetings held at Walker Building, 405 Main Street, Worcester, Mass. Daniel F. Gay, 214 Main Street, Worcester, Mass., U.S.A., Secretary.

Young Women's Camera Club.—Established November, 1894. Meetings held at the Young Women's Christian Association Rooms, Minneapolis, Minn. Miss Mabel Jameson, President. Miss M. Bells Jeffery, Vice-President. Miss Minesoa Turnbull, Treasurer. Miss M. Eva McIntyre, 1833 Portland Avenue Minneapolis, Minn., U.S.A., Secretary.

THE COPYRIGHT (WORKS OF ART) ACT (1862).

An Act for amending the Law relating to Coprright in Works of the Fine Arts, and for repressing the Commission of Fraud in the Production and Sale of such Works.

WHEREAS by law, as now established, the authors of paintings, drawings, and photographs, have no copyright in such their works, and it is expedient that the law should in that respect be amended: Be it therefore enacted by the Queen's Most Excellent Majesty, by and with the advice and consent of the Lords spiritual and temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—

Copyright in Works Hereafter Made or Sold to Vest in the Author for his Life, and for Seven Years after his Death.

1. The author, being a *British* subject or resident within the dominions of the Crown, of every original painting, drawing, and photograph which shall be or shall have been made either in the *British* dominions or elsewhere, and which shall not have been sold or disposed of before the commencement of this Act, and his assigns, shall have the sole and exclusive right of copying, engraving, reproducing and multiplying such painting or drawing, and the design thereof, or such photograph, and the negative thereof, by any means and of any size, for the term of the natural life of such author, and seven years after his death; provided that when any painting or drawing, or the negative of any photograph, shall for the first time after the passing of this Act be sold or disposed of, or shall be made or executed for or on behalf of any other person for a good or a valuable consideration, the person so selling or disposing of or making or executing the same shall not retain the copyright thereof, unless it be expressly reserved to him by agreement in writing, signed, at or before the time of such sale or disposition, by the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall be so made or executed, but the copyright shall belong to the vendee or assignee of such painting or drawing, or of such negative of a photograph, or to the person for or on whose behalf the same shall have been made or executed; nor shall the vendee or assignee thereof be entitled to any such copyright, unless, at or before the time of such sale or disposition, and agreement in writing, signed by the person so selling or disposing of the same, or by his agent duly authorised, shall have been made to that effect.

Copyright not to Prevent the Representation of the Same Subjects in Other Works.

2. Nothing herein contained shall prejudice the right of any person to copy or use any work in which there shall be no copyright, or to represent any scene or object, notwithstanding that there may be copyright in some representation of such scene or object.

Assignments, Licenses, &c., to be in Writing.

3. All copyright under this Act shall be deemed personal or moveable estate, and shall be assignable at law, and every assignment thereof, and every license to use or copy by any means or process the design or work which shall be the subject of such copyright, shall be made by some note or memorandum in writing, to be signed by the proprietor of the copyright, or by his agent appointed for that purpose in writing.

Register of Proprietors of Copyrights in Paintings, Drawings, and Photographs to be kept at Stationers' Hall, as in 5 & 6 Vict., cap. 45.

4. There shall be kept at the Hall of the Stationers' Company, by the Officer appointed by the said Company for the purposes of the Act passed in sixth year of Her present Majesty, intituled *An Act to Amend the Law of Copyright*, a book or books, entitled 'The Register of Proprietors of Copyright in Paintings, Drawings, and Photographs,' wherein shall be entered a memorandum of every copyright to which any person shall be entitled under this Act, and also of every subsequent assignment of any such copyright; and such memorandum shall contain a statement of the date of such agreement or assignment, and of the names of the parties thereto, and of the name and place of abode of the person in whom such copyright shall be vested by virtue thereof, and of the name and place of abode of the author of the work in which there shall be such copyright, together with a short description of the nature and subject of such work and in addition thereto, if the person registering shall so desire, a sketch, outline, or photograph of the said work, and no proprietor of any such copyright shall be entitled to the benefit of this Act until such registration, and no action shall be sustainable nor any penalty recoverable in respect of anything done before registration.

Certain Enactments of 5 and 6 Vict., c. 45, to Apply to the Books to be Kept under this Act.

5. The several enactments in the said Act of the sixth year of Her present Majesty contained, with relation to keeping the register book thereby required, and the inspection thereof, the searches therein, and the delivery of certified and stamped copies thereof, the reception of such copies in evidence, the making of false entries in the said book, and the production in evidence of papers falsely purporting to be copies of entries in the said book, the application to the Courts and Judges by persons aggrieved by entries in the said book, and the expunging and varying such entries, shall apply to the book or books to be kept by virtue of this Act, and to the entries and assignments of copyright and proprietorship therein under this Act, in such and the same manner as if such enactments were here expressly enacted in relation thereto, save and except that the forms of entry prescribed by the said Act of the sixth year of Her present Majesty may be varied to meet the circumstances of the case, and that the sum to be demanded by the officer of the said Company of Stationers for making any entry required by this Act shall be one shilling only.

Penalties on Infringement of Copyright.

6. If the author of any painting, drawing, or photograph in which there shall be subsisting copyright, after having sold or disposed of such

copyright, or if any other person, not being the proprietor for the time being of copyright in any painting, drawing, or photograph, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply for sale, hire, exhibition, or distribution, or cause or procure to be repeated, copied, colourably imitated, or otherwise multiplied for sale, hire, exhibition, or distribution, any such work or the design thereof, or, knowing that any such repetition, copy, or other imitation has been unlawfully made, shall import into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be imported, sold, published, let to hire, distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of the said work, or of the design thereof, made without such consent as aforesaid, such person for every such offence shall forfeit to the proprietor of the copyright for the time being a sum not exceeding ten pounds; and all such repetitions, copies, and imitations, made without such consent as aforesaid, and all negatives of photographs made for the purpose of obtaining such copies, shall be forfeited to the proprietor of the copyright.

Penalties on Fraudulent Productions and Sales.

7. No person shall do or cause to be done any or either of the following Acts: that is to say,—

First, no person shall fraudulently sign or otherwise affix, or fraudulently cause to be signed or otherwise affixed, to or upon any painting, drawing, or photograph, or the negative thereof, any name, initials, or monogram:

Secondly, no person shall fraudulently sell, publish, exhibit, or dispose of, or offer for sale, exhibition, or distribution, any painting, drawing, or photograph, or negative of a photograph, having thereon the name, initials, or monogram of a person who did not execute or make such work:

Thirdly, no person shall fraudulently utter, dispose, or put off, or cause to be uttered or disposed of, any copy or colourable imitation of any painting, drawing, or photograph, or negative of a photograph, whether there shall be subsisting copyright therein or not, as having been made or executed by the author or maker of the original work from which such copy or limitation shall have been taken.

Fourthly, where the author or maker of any painting, drawing, or photograph, or negative of a photograph, made either before or after the passing of this Act, shall have sold or otherwise parted with the possession of such work, if any alteration be afterwards made therein by any other person, by addition or otherwise, no person shall be at liberty, during the life of the author or maker of such work, without his consent, to make or knowingly to sell or publish, or offer for sale, such work or any copies of such work so altered as aforesaid, or of any part thereof, as or for the unaltered work of such author or maker.

Penalties.

Every offender under this section shall, upon conviction, forfeit to the person aggrieved a sum not exceeding ten pounds, or not exceeding double the full price, if any, at which all such copies, engravings, imitations, or altered works shall have been sold or offered for sale; and all such copies, engravings, imitations, or altered works shall be forfeited to the person, or the assigns, or legal representatives of the person whose name, initials, or monogram shall be so fraudulently signed or affixed thereto, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as aforesaid: Provided always, that the penalties imposed by this section shall not be incurred unless the person whose name, initials, or monogram shall be so fraudulently signed or affixed, or to whom such spurious or altered work shall be so fraudulently or falsely ascribed as beforesaid, shall have been living at or within twenty years next before the time when the offence may have been committed.

Recovery of Pecuniary Penalties.

8. All pecuniary penalties which shall be incurred, and all such unlawful copies, imitations, and all other effects and things as shall have been forfeited by offenders, pursuant to this Act, and pursuant to any Act for the protection of copyright engravings, may be recovered by the person hereinbefore and in any such Act as aforesaid empowered to recover the same respectively, and hereinafter called the complainant or the complainer, as follows:

In *England* and *Ireland*, either by action against the party offending or by summary proceeding before any two Justices having jurisdiction where the party offending resides:

In *Scotland*, by action before the Court of Session in ordinary form, or by summary action before the Sheriff of the County where the offence may be committed or the offender resides, who, upon proof of the offence or offences, either by confession of the party offending or by the oath or affirmation of one or more credible witnesses, shall convict the offender, and find him liable to the penalty or penalties aforesaid, as also in expenses; and it shall be lawful for the Sheriff, in pronouncing such judgment for the penalty or penalties and costs, to insert in such judgment a warrant, in the event of such penalty or penalties and costs not being paid, to levy and recover the amount of the same by poinding: Provided always, that it shall be lawful to the Sheriff, in the event of his dismissing the action and assoilzieing the defender, to find the complainer liable in expenses, and any judgment as to be pronounced by the Sheriff in such summary application shall be final and conclusive, and not subject to review by advocation, suspension, reduction, or otherwise.

Superior Courts of Record in which any Action is Pending may Make an Order for an Injunction, Inspection, or Account.

9. In any action in any of Her Majesty's Superior Courts of Record at *Westminster* and in *Dublin*, for the infringement of any such copyright as aforesaid, it shall be lawful for the Court in which such action is pending, if the Court be then sitting, or if the Court be not sitting then, for a judge of such Court, on the application of the plaintiff or defendant respectively, to make such order for an injunction, inspection, or account, and to give such direction respecting such action, injunction, inspection, or account, and the proceedings therein respectively, as to such Court or Judge may seem fit.

Importation of Pirated Works Prohibited.—Application in such Cases of Customs Act.

10. All repetitions, copies, or imitations of paintings, drawings, or photographs, wherein or in the design whereof there shall be subsisting copyright under this Act, and all repetitions, copies, and imitations of the design of any such painting or drawing, or of the negative of any such photograph, which, contrary to the provisions of this Act, shall have been made in any Foreign State, or in any part of the *British* dominions, are hereby absolutely prohibited to be imported into any part of the United Kingdom except by or with the consent of the proprietor of the copyright thereof, or his agent authorised in writing; and if the proprietor of any such copyright, or his agent, shall declare that any goods imported are repetitions, copies, or imitations of any such painting, drawing, or photograph, or of the negative of any such photograph, and so prohibited as aforesaid, then such goods may be detained by the Officers of Her Majesty's Customs.

Saving of Right to Bring Action for Damages.

11. If the author of any painting, drawing, or photograph, in which there shall be subsisting copyright, after having sold or otherwise disposed of such copyright, or if any other person, not being the proprietor for the time being of such copyright, shall, without the consent of such proprietor, repeat, copy, colourably imitate, or otherwise multiply, or cause to procure to be repeated, copied, or colourably imitated, or otherwise multiplied, for sale, hire, exhibition, or distribution, any such work or the design thereof, or the negative of any such photograph, or shall import or cause to be imported into any part of the United Kingdom, or sell, publish, let to hire, exhibit, or distribute, or offer for sale, hire, exhibition, or distribution, or cause or procure to be sold, published, let to hire, exhibited, or distributed, or offered for sale, hire, exhibition, or distribution, any repetition, copy, or imitation of such work, or the design thereof, or the negative of any such photograph, made without such consent as aforesaid, then every such proprietor, in addition to the remedies hereby given for the recovery of any such penalties, and forfeiture of any such things as aforesaid, may recover damages by and in a special action on the case, to be brought against the person so offending, and may in such action recover and enforce the delivery to him of all unlawful repetitions, copies, and imitations, and negatives of photographs, or may recover damages for the retention or conversion thereof: Provided that nothing herein contained, nor any proceeding, conviction, or judgment, for any act hereby forbidden, shall effect any remedy which any person aggrieved by such Act may be entitled to either at law or in equity.

Provisions of 7 *&* 8 *Vict., c.* 12, *to be Considered as Included in this Act.*

12. This Act shall be considered as including the provisions of the Act passed in the Session of Parliament held in the seventh and eighth years of Her present Majesty, intituled *An Act to Amend the Law relating to International Copyright*, in the same manner as if such provisions were part of this Act.

PRINCIPAL FOREIGN PHOTOGRAPHIC PERIODICALS.

FRANCE.

Bulletin de la Société Française de photographie.—Published by Gauthier-Villars et fils, quai des Grands-Augustins, 55, Paris.

Moniteur de la photographie.—Gauthier-Villars et fils, 55, quai des Grands-Augustins, Paris.

Bulletin du Photo-Club de Paris.—40, rue des Mathurins, Paris.

Photo-Gazette.—3, rue Racine, Paris.

GERMANY.

Photographisches Wochenblatt.—Potsdamerstrasse, 89, Berlin.

Deutsche Photographen Zeitung.—Weimar.

Photographisches Archiv.—E. Liesegang, Düsseldorf.

Photographisches Mittheilungen.—Prof. Dr. H. W. Vogel, 124, Kurfuerstein-Str. Berlin.

Der Amateur Photograph.—Dr. Paul Liesegang, Dusseldorf.

AUSTRIA.

Die Photographie.—17, Theresiengasse, Vienna.

Photographische Correspondenz.—Ludwig Schrank, Hauptstrasse, 9, Vienna, Austria.

Photographische Rundschau.—Charles Scolik, Paristengasse, 48, Vienna.

BELGIUM.

Bulletin de l'Association belge de photographie.—M. Ch. Puttemans, palais du Midi, Brussels.

Helios.—103, boulevard de la Senne, Brussels.

UNITED STATES.

Photographic Times.—423 Broome Street, New York.

Anthony's Photographic Bulletin.—591 Broadway, New York.

American Amateur Photographer.—239–241 Fifth Avenue, New York.

Photo American.—9 East 17th Street, New York.

Photo Beacon.—The Beacon Publishing Company, Tribune Building, Chicago, Illinois.

Saint Louis and Canadian Photographer.—2700 Pine Street, Saint Louis, Missouri.

Wilson's Photographic Magazine.—853 Broadway, New York.

INDIA.

Journal of the Photographic Society of India.—Calcutta.

St. Veronica.—2 Marquis Street, Calcutta.

ITALY.

Bolletino della Società fotografica Italiana.—Via del Giglio, Florence.

Bolletino dell' Associazione degli Amatori di Fotografia.—25, Via Poli Rome.

Dilettante di Fotografia (Il).—Milan.

Revista Scientifico-Artistica di Fotografia.—30, Via Principe Umberto Milan.

Il Progressio Fotografico.—Via S. Maria Sogreta, Milan.

JAPAN.

Sashin Shimpo.

RUSSIA.

Bulletin mensuel de la Société Impériale russe, Section de la photographie. 2, Pantelemenskaja, St. Petersburg.

SWEDEN.

Fotografisk Tidskrift.—Albin Roosval, Stockholm.

SWITZERLAND.

Revue suisse de photographie.—40, rue du Marché, Geneva.

LIST OF THE PRINCIPAL TEXT-BOOKS ON PHOTOGRAPHY.

[THE books mentioned below are obtainable by order of all photographic dealers.]

Burton's Modern Photography. By W. K. Burton. 1*s.*

Early Work in Photography. By W. Ethelbert Henry, C.E. 1*s.*

Guide to Practical Photography. By T. N. Armstrong. 1*s.*

Instruction in Photography. By Sir William Abney. 10th Edition. Revised and Enlarged. 6*s.*

Science and Practice of Photography. By Chapman Jones. 3*s.* 6*d.* 2*s.* 6*d.*

Photography with Emulsions. By Sir William Abney, F.R.S. 3*s.*

The First Principles of Photography. By Clement J. Leaper. 5*s.*

Photo-ceramics. Photography applied to the decoration of Plaques, Pottery, and other Ceramic and Metallic Surfaces. By W. Ethelbert Henry, C.E., and H. Snowden Ward. 1*s.*

Photographic Enlargements. How to Make Them. By Geo. Wheeler. 1*s.*

Bromide Paper. Instructions for Contact Printing and Enlarging. By Dr. E. A. Just. 1*s.* 6*d.*

Bromide Enlarging and Contact Printing. By S. Herbert Fry. 6*d.*

Negative-making. By Sir William Abney, F.R.S. 1*s.*

Artistic Lighting. By James Inglis. 4*s.* 6*d.*

Instantaneous Photography. By Sir William Abney, F.R.S. 1*s.*

The Lighting in Photographic Studios. By P. C. Duchochois. Revised, with additional matter by W. Ethelbert Henry, C.E. 1*s.*

Chemistry for Photographers. By Charles F. Townsend, F.C.S., F.R.P.S. 1*s.*

Art of Retouching Negatives, and Finishing and Colouring Photograms. By Robert Johnson. 2*s.*

Art of Retouching. By J. Hubert. 1*s.*

Enamelling and Retouching. By Piquepe. Cloth. 1*s.*

Art and Practice of Silver Printing. By H. P. Robinson and Sir William Abney. 2*s.* 6*d.*

Platinotype: Its Preparation and Manipulation. By Sir William Abney and Lyonel Clark. 2*s.* 6*d.*

Lens Work for Amateurs. By Henry Orford. 3*s.*

Photographic Optics, A Treatise on. By R. S. Cole. 6*s.*

The Optics of Photography and Photographic Lenses. By J. Traill Taylor. 3*s.* 6*d.*

Optics for Photographers. By W. K. Burton. 1*s.*

Photographic Lenses. How to Choose and How to Use. By John A. Hodges. 2*s.*

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Imperial Institute.—The Secretary.

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SUMMARY.

THE section of the ALMANAC which is headed "Epitome of Progress" will inform the reader of the most recent advances in photography, especially in relation to the subject of colour reproduction. Some minor indications of progress may be briefly scanned in this summary. The closing year has witnessed very great activity in photographic manufacturers. Scarcely a month has passed without the introduction of new developing agents; printing papers; toning, intensifying, and reducing compounds; whilst makers of apparatus and lenses, dry plates, and flexible films have by no means been content to adhere to old paths, but have attracted the notice of photographers by the aid of novel introductions. In photography, as in so many other cases, the public appetite for something new defies appeasement. The task of sifting out from these marks of activity what is really progressive and what is not is a difficult one unless the tests of time and experience are at hand to enable one to form an accurate judgment in the matter; but a few observations on some obvious tendencies may be worth while recording.

LENSES.—Messrs. Zeiss have introduced the "Unar" and Messrs. Beck the Beck-Steinheil Orthostigmat Lenses to photographers. The latter is described in the section, "Recent Novelties in Apparatus." We append a description of the properties of the "Unar," published after practical trial by Mr. Philip Everitt. At a meeting of the London and Provincial Photographic Association, Mr. Everitt showed a "Unar" lens of 8¼ inches focus, listed to cover, at its full aperture of *f*-5, a plate measuring 6¼×4¾. Two photographs were shown, taken at full aperture; but, as they were on 7½×5 plates, a corresponding allowance would have to be made. The qualities claimed for the lens were flatness of field, great rapidity, and extensive covering power. The lens was of the same rank as the Petzval portrait lens for rapidity, but with a much larger angle and more even illumination throughout the field. His practical experiments were limited to the two negatives shown. One of these was to indicate the possibilities of the lens for portraiture at full aperture. The quality of the definition he considered very fine. The second plate was of a drawing-room window, showing blinds, curtains, &c., all of which were faithfully rendered to the edges. Mr. Everitt thought a lens with the qualities claimed for this was specially valuable to the professional man. It was a portrait lens, a group lens, and a lens for practically every purpose. Each half was composed of two lenses with an air space, yet no disturbing reflections arose—a great achievement in an instrument of this kind. A cursory examination showed that the back half of the lens was about 7 inches focus, and was uncorrected chromatically. The burden of correction for colour was thus thrown on the entire combination, and the two halves could not be separately used. The back lens, however, was corrected for astigmatism. Simplicity of construction is one of the features of the "Unar" lens, and it is probable that it will be followed by other lenses, which, if marking no important optical advance, will be very much simplified in form—a distinct gain to the optician, if not to the photographer. Indeed we are cognisant of the fact that some of our leading opticians are at present experimenting with this object.

Film Photography.—Cristoid (a flexible gelatine film), Secco (a gelatine film which is stripped from its paper support), and "Glassoline" (a gelatine film which also strips from a paper support, rendered translucent in manufacture), and non-stripping negative paper, are now competing with glass plates and cut and rollable celluloid; so that in the important respect of negative-making the photographer is offered a very wide choice. The remarkable feature of this matter is that, while film photography is becoming daily more popular, the use of glass plates shows no falling off—on the contrary, from what we hear, this branch of photographic manufacturing is steadily growing.

The War and Photography.—The war in South Africa was the direct means of showing the capabilities of photography as a method of popular illustration, and the advances in this respect made during the last eighteen months have been remarkable. In future the rapid production of photographs for illustrating daily or weekly newspapers promises to be an important factor in journalism, to which photographers, inventors, and others might profitably give attention. Telephotography was also brought into prominence by the war; but how far the lens, the camera, and the sensitive surface were of assistance to the military authorities in the field operations there has yet been no opportunity of ascertaining. The war also served to sustain the popularity of cinematograph entertainments; but for the time being it reacted adversely on ordinary projection entertainments, and consequently marred last winter's optical lantern trade. Perhaps we must wait for another season until the optical lantern fully regains its place in the affections of the public.

Apparatus.—The Kodak Company, with the cheap and clever "Panoram" Kodak, brought out one of the most attractive novelties of the year, during the whole of which this enterprising house was constantly stimulating public interest in photography. Messrs. Beck, Messrs. Adams, Messrs. Watson, Messrs. Newman & Guardia, and other firms, also brought out new cameras, which are described in detail in the section of the ALMANAC headed "Recent Novelties in Apparatus." There has been a steady influx of several kinds of American-made hand cameras, and several of the cheaper varieties also owe their sources of origin to France and Italy. On the whole it cannot be said that British photographic apparatus makers hold their own against their foreign competitors in the production of cheap cameras, &c., although for strength of construction, allied with beauty of finish and practical utility, the better classes of English apparatus are unexcelled.

TONING, DEVELOPING, PRINTING, &C.—To Mr. W. B. Ferguson, Q.C., the photographic world is indebted for a valuable process of copper toning. An abstract of the author's paper on the subject, read before the Royal Photographic Society, is given in the "Epitome of Progress." Messrs. Lumiere introduced ceric sulphate as a reducer; and Messrs. Merck, Messrs. J. J. Griffin and Sons, and some of the German manufacturing chemists, have been busily occupied in increasing the list of developing compounds. "Ozotype," Mr. Thomas Manly's ingenious modification of the carbon process, has engaged much public attention; but it is too soon to assign it a place amongst modern photographic printing processes.

The number of Photographic Societies is gradually increasing, and it is unquestioned that amateur photography is distinctly spreading. The inflation that seized it some years ago having subsided, the process-block trade has shrunk to the narrow limits defined by commercial requirements. Professional photography of the portraiture and landscape classes shows a tendency to respond to the demands of the public for high-class work; but there are no indications as yet of the ultra-pictorial work, about which so much is written and said, finding favour outside a very small circle. Such institutions as the Royal Photographic Society, the Photographic Convention of the United Kingdom, and the Photographic Copyright Union flourish, and are doing excellent work; but the Photographers' Benevolent Association has at last succumbed to neglect. During the last Parliamentary session three Bills designed to more or less adversely affect photographic copyright were introduced to the House of Lords, and it is practically certain that when the Legislature meets in the spring the subject will be revived. It behoves all photographers to be alert, lest their interests are adversely affected. The Act of 1862, which is printed in this ALMANAC, deals fairly and equitably with photographic copyright, and it should be the aim of photographers to secure the retention of that Act in its entirety.

OBITUARY OF THE YEAR.

Amongst those prominent in photography who have died since the last Almanac, the following may be singled out for special reference here:—

Thomas Edge,
Professor Piazzi Smyth,
J. A. Harrison,
W. McLeish,
Leon Warnerke,
Thomas Fall,
Dr. Wilhelm Zenker,
Dr. Carl Schleussner.

Thomas Edge.

Mr. Edge was a successful portrait photographer for nearly thirty years in the earlier days, and by some of our older readers will be remembered for his improvements in studio construction and studio lighting, as well as for his method of double printing, with inserted foregrounds and backgrounds, a system frequently described in our pages. In the earlier days of carbon he was one of the best and most successful workers in that line, and in the early days of platinum he was also a pioneer. During the last few years an almost complete loss of eyesight caused him to give up photography, which he had continued as a hobby even after retiring from it as a business, and he then developed a method of building up various scenes from pieces of cork, lichen, sand, &c., which he could see to do in a good light, and photographing the results. In this way he produced very many fancy pictures.

Professor Piazzi Smyth.

Professor Charles Piazzi Smyth, late Astronomer Royal for Scotland, began his astronomical career at the Cape of Good Hope sixty-five years ago, afterwards assisting in the remeasurement of La Caille's South African Arc of the Meridian. When appointed to his Scottish post, he set himself to clear off some five years of arrears of work in computation. In 1859 he visited the Russian observatories, and made a report upon them. The work by which he is best known is "Life and Work on the Great Pyramid." In August, 1888, he retired to Ripon, where he devoted himself to spectroscopy and to the study of cloud forms. In former years Professor Smyth was a frequent and valued contributor to the Journal and this Almanac.

J. A. Harrison.

The late Mr. Harrison will be chiefly remembered in connection with the Pantascopic Camera, of which he and the late J. R. Johnson were the inventors over thirty years ago. Of this camera the late Mr. Traill Taylor, in the ALMANAC of 1892, gave the following description and opinion :—"Probably no camera which has ever been introduced at all approaches in mechanical ingenuity the one I shall now endeavour to describe. Although every part of it, except the stand, is in motion by means of clockwork during the taking of the picture, such is the perfection of both its principle of construction and its workmanship that I have frequently subjected negatives taken by one in my possession to examination under a compound microscope, the limit to the power employed being that degree of amplification at which the silver granules forming the collodion image became too pronounced.

"The pantascopic camera is composed of a small chamber capable of rotating freely on a strong pin fixed in a circular base plate. This pin is situated directly under the optical centre of the lens. The back is closed, all but a narrow slot reaching from top to bottom, and has wings fitted to it for the purpose of opening or narrowing the slot, or making it wider opposite the foreground and closer for the sky, so that, no matter how dark the one and how bright the other, the picture will be harmoniously rendered. Attached to and projecting laterally from each side of the camera is a steel rail, on which runs, on two castors, a carriage bearing the dark slide, which is covered with an endless band of opaque cloth running over two rollers at each end of the carriage, and is attached to the camera proper by means of a brass flange. The edge of the circular plate on which the camera rotates is grooved, and on this groove two strings fold, one end of each being attached to the base, the other to the carriage that carries the dark slide. The camera rotating, and the base being stationary, the strings fold and unfold respectively, giving a rectilinear motion to the carriage, which runs upon the rail at the back of the camera. The diameter of the circular plate upon which the strings fold has a definite relation to the focus of the lens, and thus the relative motion of sensitive plate and lens is obtained. The plate is therefore always tangential to the supposed cylinder upon which the image ought to be received. The camera is driven by clockwork so arranged that a perfectly uniform motion is maintained during the whole time that the camera is being rotated. The dimensions of the plate depend, of course, upon the focus of the lens and the angle of view to be obtained. If the focus of the lens be 3¾ inches, which is that in our camera, then, if the whole horizon is to be included, the length of the plate must equal the circumference of a circle whose radius equals the focus of the lens. Our camera, however, is fitted for ½-plates, and on these we secure an angle of 120° on the base line, the extreme ends being necessarily as sharp as the centre.

"When in action, the camera, carrying the carriage with the dark slide, moves round the central pivot below the optical centre of the lens. The carriage, at the same time, has a movement of translation from one end of the rail to the other, this being effected by the strings spoken of. The axial rays only of the lens are employed in forming the image, hence there is no distortion.

"Pantascopic negatives of the size above indicated have yielded enlargements 36×12 inches, in which there is no want of sharpness. The perspective is panoramic. This invention was originated in 1862, but it was three year later ere it was quite perfected."

Many other ingenious mechanical photographic devices of which he was the inventor were from time to time exhibited by the late Mr. Harrison at various societies, including the South London, the Photographic Club, the London and Provincial, the Royal, &c.

W. McLeish.

Mr. McLeish was a native of Perthshire, and went to Darlington about forty years ago. Changing his occupation from that of gardener, he became a photographer, occupying for some years a wooden erection in Grange-road, Darlington. The measure of success that he achieved in the years that followed showed that he had found his forte in taking up photography. After a few years at the above place, he removed to Northgate, and there he remained until the end, living in rooms adjoining his establishment.

In his professional labours he was gifted, painstaking, and original, and made a name for himself far beyond the bounds of Teeside. It was in the early eighties that Mr. McLeish first made his name with the famous photograph, "A Misty Morning on the Wear." This picture created a sensation, and was one of the chief exhibits in the Pall Mall Exhibition of the year. Of this photograph between 2000 and 3000 copies have been printed, till the negative has become defective; but copies have gone all over the world.

Leon Warnerke.

Although during the last two or three years Mr. Warnerke's participation in British photographic work was very slight, for nearly a quarter of a century his activity had been incessant. Hungarian by birth, he settled in England about 30 years ago, his profession being that of civil engineer. A taste for photography led him into the paths of experiment, and from a brief biography of him which was published in THE BRITISH JOURNAL OF PHOTOGRAPHY nearly seventeen years ago, we learn that he first appeared prominently before the photographic public in 1875, when, at a meeting of the old South London Photographic Society, he read a communication on "Paper versus Glass," and exhibited and described his roller slides and sensitive collodion tissue. In 1876 he addressed the Photographic Society of Great Britain on the subject of "Investigations in Collodion Emulsion," in which he gave the results of a series of experiments on the relative values of different salts for emulsion purposes.

From that date forward the record of Mr. Warnerke's writings and papers would be a very lengthy one, for he did not confine himself to the societies and journals of this country, but made frequent appearances at photographic societies in Russia, Belgium, Germany, and France. At St. Petersburg, twenty years ago, he founded a photographic society and a photographic journal, and we believe that at one time he was commercially interested in dry-plate making in that city. In 1877 he was awarded the prize offered by the Photographic Association of Belgium for the best dry process, and in 1881 the Process Medal of the Photographic Society of Great Britain was conferred upon him. Until a year ago he was a member of the Society's Council, and one of its most active supporters.

One branch of work brought him very prominently before photographers—actinometry and sensitometry. The Warnerke Actinometer was based upon the employment of a phosphorescent tablet, upon which to record the impress of the light's action, whilst the well-known sensitometer, which bears—or, rather, bore—his name, also utilised the same principle, and was for a long time the recognised and, indeed, the only, standard of speed measurement for dry plates. Until comparatively recently most, if not all, dry plate-makers indicated the speeds of their plates by readings obtained on the Warnerke sensitometer. We believe that to Mr. Warnerke was due the credit of the establishment of the lens standards of the Photographic Society of Great Britain, a committee having been appointed by the Society at his suggestion to take the matter into consideration. He was a constant attendant at the various Photographic Congresses, and it may in brief be said of him that British photography is distinctly the richer by the close touch which he served to establish and maintain between photographic progress in this country and abroad.

In more recent years, we remember the very exhaustive account he gave of photographic educational institutions in Berlin, Vienna, and other Continental cities. It was Mr. Warnerke who introduced the well-known optician, Mr. C. P. Goerz, to a meeting of the Photographic Society, when the double anastigmat lens was first exhibited in this country, and to him that English photographers were indebted for sustaining interest in the Lippmann process of interference colour-photography, Messrs. Lumiere's remarkable results being shown by him at a Society of Arts meeting in the year 1893.

Thomas Fall.

Mr. Fall had just entered his 67th year. He was born at Leyburn, in North Yorkshire. He was apprenticed to lithographic printing, but in his early manhood took up photography, first as a travelling worker, and afterwards built a studio in Bedale. On coming to London, his first engagement was with the (then) new firm of Elliott & Fry. For many years he enjoyed a wide reputation for portraiture, being especially happy with children, and latterly he devoted himself to animal photography with great success.

Dr. Wilhelm Zenker.

Dr. Wilhelm Zenker was a distinguished astronomer and physicist, and was the author of the first work on photography in natural colours, his "Lehrbuch der Photochromie" being published in 1868. This work is of special interest, as in it he fully explained the formation of colour photographs by stagnant waves, which is, as is well known, the fundamental theory of Lippmann's well-known work.

Dr. Carl Schleussner.

Dr. Carl Schleussner, one of Germany's most prominent theoretical and practical workers in the different branches of photography since its early days, had a large laboratory for the manufacture of chemicals, particularly collodion and nitrate of silver, but he was more extensively known by his dry plates, which enjoy a high reputation in Germany. For many years he was President of the Verein zur Pflege der Photographie at Frankfort.

EXPOSURE TABLES AND EXPOSURE METERS.

By the Editor.

CHAPTER I.

INTRODUCTORY.

In the following chapters an attempt has been made to present, for the first time in a collected form, a mass of data, drawn from various sources, relating to exposure tables and exposure meters.* Especially by photographers new to the subject the difference between a table and a meter is not always appreciated. A table gives in the form of numerical values some factors which have to be considered in the estimation or calculation of exposures; the meter remedies the principal defect of the table by substituting for a light factor, determined very largely by individual judgment, an actual measurement of the light value at the time of exposure. Both tables and meters have their uses in aiding the photographer to overcome an ever-present difficulty in his work: but it must be obvious that the substitution of a method of quantitative measurement for an unreliable personal equation in exposure calculations diminishes the risk of error. In other words, reliance upon tables may improve one's judgment in estimating exposures, but cannot assure the certainty of accuracy derivable only from the application of precise measurements.

Before the introduction of gelatine dry plates experience was the chief, if not the only guide, in exposure. Wet collodion plates could not very well be subjected to a system of speed determination, for nothing of the kind existed. Oftener than not, the photographer did not trouble to acquaint himself with the *f*-values of his lens diaphragms—indeed to this day the amount of ignorance on this point is quite surprising—so that these two important "factors," as we should call them, were, as a rule, neglected in the primitive form of exposure calculations in vogue prior to the advent of gelatine plates. The photographer entirely relied upon his experience in estimating the value of the light in the course of its yearly changes, and it must be confessed that in the good old days the accuracy with which exposures were usually estimated in the studio and the field said much for the combination of skill and judgment photographers then possessed.

But when gelatine dry plates superseded wet collodion the need of some system of determining their sensitiveness, or, as we should now call it, their speed, soon made itself felt. Photographers were slow to realise the great increase in rapidity which the new process placed in their hands; and when, after some years' practical acquaintance with highly sensitive gelatine films, habitual workers found it possible to gauge, with reasonable accuracy, the time of exposure required, it was quite common to hear or read their references to the sensitiveness (or speed) of the new dry plates as being "so many times wet collodion"—ten, fifteen, twenty, or thirty, as the case might have been, which meant, of course, that gelatine exposures were reduced to a tenth, a fifteenth, a twentieth, or a thirtieth of what they were in similar conditions with wet plates. Perhaps to the very modern photographer no more striking idea of the complete revolution in photographic exposures which the displacement of wet collodion by dry gelatine brought about could be imparted than by the above comparison. Even to this day the very first system of "speed marking of plates" survives in practical use, as the Paget XXX and XXXXX plates remind us.

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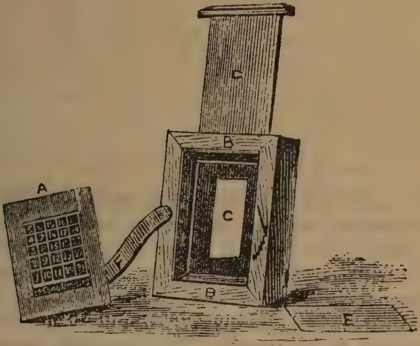
* See note at end of p. 706.

Originally, I believe, they were known as 30 and 50 times wet-collodion, and the photographer of twenty or more years ago found these descriptions sufficiently close and accurate for his purpose. To-day, however, Paget XXX and Paget XXXXX plates are known as distinctive brands, whose rapidity few of their many users have, or have had, opportunity of comparing with wet collodion.

CHAPTER II.

THE WARNERKE SENSITOMETER.

The first important step in the speed marking of plates was taken by the late Mr. Leon Warnerke, who over 20 years ago introduced the sensitometer which bears his name. This instrument, with the manner of its use, formed the subject of a paper before the Photographic Society of Great Britain in 1878, and it was also described in The British Journal of Photography at subsequent dates. But the simplest account of it appears in Sir William Abney's "Instruction in Photography," a book that has passed through many editions, and is one of my oldest photographic friends. The opening lines of this description were written about the year 1882: "Perhaps the most difficult part of the gelatine process is to gauge the right exposure to be given in the camera. The time during which the lens should be uncovered varies between the fiftieth part of a second and a couple of hours; 1st, according to the sensitiveness of the plate; 2nd, according to the general light; 3rd, according to the nature of the view; and 4th, according to the available aperture of the lens. In order to ascertain the sensitiveness of the plate, a very useful piece of apparatus is Warnerke's sensitometer. It consists of a piece of glass, A, covered with squares of pigmented gelatine, each square having painted on it an opaque number. The light penetrating through one of these squares is about one-third less intense than the number immediately preceding it. By exposing a plate behind such a sensitometer to a constant light, such as a phosphorescent tablet, E, which is sent out with the instrument, or a candle which has burnt five minutes, and placed at a fixed distance from the apparatus during exposure, the relative rapidities of any plates may be ascertained. The tablet, A, fits into the dark slide, B. In C is an opening through which the phosphorescent tablet can shine when the board, D, is pulled up. A plate, or a piece of a plate, rests on A when in position, and then the back is placed on it. The phosphorescent plate, E, is exposed to the light from magnesium ribbon, an inch of the latter being sufficient to give full illumination to it. It is placed in position, as above indicated, and, after a minute has elapsed from the time of burning the wide, D is pulled out and exposure given for half a minute. Then D is closed, and the plate taken out and developed. The following table, compiled by Mr. Cadett, gives the comparative sensitiveness of plates, which show different numbers:—



Sens. No.	*Number of Times more Sensitive than Sens. No.*										
	25	24	23	22	21	20	19	18	17	16	15
25	1	1⅓	1¾	2⅓	3	4	5	7	9	12	16
24	...	1	1⅓	1¾	2⅓	3	4	5	7	9	12
23	...	...	1	1⅓	1¾	2⅓	3	4	5	7	9
22	...	...	...	1	1⅓	1¾	2⅓	3	4	5	7
21	...	...	...	...	1	1⅓	1¾	2⅓	3	4	5
20	...	...	...	...	...	1	1⅓	1¾	2⅓	3	4
19	...	...	...	...	...	...	1	1⅓	1¾	2⅓	3
18	...	...	...	...	...	...	...	1	1⅓	1¾	2⅓
17	...	...	...	...	...	...	...	...	1	1⅓	1¾
16	...	...	...	...	...	...	...	...	...	1	1⅓
15	...	...	...	...	...	...	...	...	...	...	1

Supposing it is desired to compare the rapidity of two plates showing different numbers, look for the higher number in the column on the left side of the table, and the lower one in the top horizontal row of numbers, then run the eye along the line of the number in the left-hand column until you come to the figure under the lower number; the figure will then show the number of times more sensitive is the plate showing the higher number than the plate showing the lower number. For instance, a plate showing 21 is four times more sensitive than one showing 16; one showing 20 is three times more sensitive than one showing 16, and so on." The above described system of obtaining sensitometer numbers (or speed readings) by the development of a series of exposures made under conditions that were proved to vary was employed by several plate makers for many years, notwithstanding that its defects were pointed out by leading authorities in The British Journal of Photography. But is now obsolete, and the only point of interest it has for us on this present occasion is that, taking the Warnerke sensitometer numbers as a basis, Mr. James Cadett, of the now well-known house of Cadett and Neall, drew up the first recorded table of plate speeds, which was in widespread use in the decade 1880-1890.

CHAPTER III.

BURTON'S EXPOSURE TABLES, &c.

The late W. K. Burton was about the first prominent photographer to undertake the tabulation of a series of exposures for different subjects at varying apertures of the lens, and the appended table which

Aperture calculated on Standard System of Photo. Society.	Sea and Sky.	Open Landscape.	Brightly Lighted Street Scenes.	Landscapes with Heavy Foliage in Foreground.	Under Trees, up to	Fairly Lighted Interiors, up to	Badly Lighted Interiors, up to	Portraits in Bright Diffused Light out of Doors	Portraits in Ordinary Room.
	secs.	secs.	secs.	secs.	min. sec.	min. sec.	hrs. min.	secs.	secs.
·25, or f-2 ..	$\frac{1}{3200}$	$\frac{1}{1200}$	$\frac{1}{400}$	$\frac{1}{160}$	0 $\frac{1}{2}$	0 $\frac{1}{2}$	0 $\frac{1}{10}$	$\frac{1}{160}$	$\frac{3}{20}$
·5, or f-2·825	$\frac{1}{1600}$	$\frac{1}{600}$	$\frac{1}{200}$	$\frac{1}{80}$	0 1	0 1	0 $\frac{1}{5}$	$\frac{1}{80}$	$\frac{3}{10}$
·1, or f-4 ..	$\frac{1}{800}$	$\frac{1}{300}$	$\frac{1}{100}$	$\frac{1}{40}$	0 2	0 2	0 $\frac{2}{5}$	$\frac{1}{40}$	$\frac{3}{5}$
2, or f-6·57 .	$\frac{1}{400}$	$\frac{1}{150}$	$\frac{1}{50}$	$\frac{1}{20}$	0 4	0 4	0 $\frac{4}{5}$	$\frac{1}{20}$	$1\frac{1}{5}$
4, or f-8	$\frac{1}{200}$	$\frac{1}{75}$	$\frac{1}{25}$	$\frac{1}{10}$	0 8	0 8	0 $1\frac{3}{5}$	$\frac{1}{10}$	$2\frac{2}{5}$
8, or f-11·514	$\frac{1}{100}$	$\frac{1}{38}$	$\frac{1}{12}$	$\frac{1}{5}$	0 16	0 16	0 3	$\frac{2}{10}$	5
16, or f-16 ..	$\frac{1}{50}$	$\frac{1}{19}$	$\frac{1}{6}$	$\frac{2}{5}$	0 32	0 32	0 6	$\frac{2}{5}$	10
32, or f-22·627	$\frac{1}{25}$	$\frac{1}{10}$	$\frac{1}{3}$	$\frac{4}{5}$	1 4	1 4	0 13	$\frac{4}{5}$	20
64, or f-32 ..	$\frac{1}{12}$	$\frac{1}{5}$	$\frac{2}{3}$	$1\frac{3}{5}$	2 8	2 8	0 25	$2\frac{3}{5}$	40
128, or f-44·25	$\frac{1}{6}$	$\frac{2}{5}$	$1\frac{1}{3}$	$3\frac{1}{5}$	4 16	4 16	0 50	5	80
256, or f-64	$\frac{1}{3}$	$\frac{4}{5}$	$2\frac{2}{3}$	$6\frac{2}{5}$	9 2	9 2	1 40	10	160

OLD LENSES. NEW LENSES.

OLD LENSES.—A, Portrait Lenses; B, Rapid Landscape Lenses and Universals; C, Wide-angle and Single Achromatic Lenses.

NEW LENSES.—D, Extra Rapid Lenses; E, Very Rapid Lenses; F, Rapid Lenses; G, Single Anastigmatic Lenses and Wide-Angle Lenses.

I extract from the very last edition of his useful little book, "Modern Photography" (1899)*, does not in the main depart from the arrangement of that which he issued about the year 1886. This table hardly requires explanation to modern photographers, and is only noteworthy in respect of the top row of comparative exposures, which, in my opinion, can hardly be improved upon as affording a beginner some idea of the difference in actinic value of a number of familiar subjects that he is likely to make exposures on. The relation of lens aperture to focus, as expressed in column one, goes without saying; but the remainder of the table, as I can vouch from actual experience of every branch of work mentioned in it, fits so excellently with what one arrives at in practice, that it is a valuable tribute to Burton's judgment.

Two other tables which in most of the text books are found associated with Burton's table may usefully be given here. The first is known as Platt's table of subject and light factors, partly compiled from Burton's data. It is chiefly notable for the fact that it deals with the light factor discriminatingly, and arrives at a series of comparative subject values differing from those of Burton.

	Sunshine.	Diffused light.	Dull	Very dull.	Gloomy.
Sea and sky	¼				
Panoramic view (open landscape)	1	2	3	4	5
,, with thick foliage or strong foreground............	2	4	6	8	10
Dark buildings	3	6	9	12	15
Heavy foliage, foreground	4	8	12	16	20
Woods and badly-lit river banks	10	20	30	40	50
Living objects outdoors	4	8	12	20	30
Portrait near window	8	16	24	40	60
Interiors (according to light). *Upwards of*	100	200	300	400	500
Copying same size.....	6	12	20		

The third table is that of Dr. J. A. Scott, showing monthly and daily variation of the light values for countries about latitude 53°—the British Isles, North Germany, Canada, &c. This is one of a series the remainder of which I have printed in a subsequent chapter.

The three tables quoted in this chapter probably form to some extent the basis of all modern exposure tables. Lens aperture, subject, and intensity of light, calculated or empirical, are, it will be observed, taken into account; but the plate and its speed are overlooked. All these tables, however, find their use in assisting the judgment of the photographer in making exposures on a variety of subjects under different conditions of lens aperture and illumination. They in no sense pretend to supply him with a measure of the exposure to be given.

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* Published by Carter & Co , 5 Furnival Street, Holborn. E.C.

Hour of Day. A.M. P.M.	June	May or July	April or Aug.	Mar. or Sept.	Feb. or Oct.	Jan or Nov.	Dec.
12	1	1	1¼	—	2	3½	4
11 or 1	1	1	1¼	1½	2½	4	5
10 or 2	1	1	1¼	¾	3	5	6
9 or 3	1	1¼	1½	2	4	—	*16
8 or 4	1½	1½	2	3	*10	—	—
7 or 5	2	2½	3	*6	—	—	—
6 or 6	2½	*3	*6	—	—	—	—
5 or 7	*5	*6	—	—	—	—	—
4 or 8	*12	—	—	—	—	—	—

CHAPTER IV.

TYPICAL EXPOSURE TABLES.

Typical of many simple exposure tables arranged for the months of the year, I select a few from those published some time ago by

MAY, JUNE,	Sunshine ...... *f*-8 Cloudy ...... *f*-5·6 Dull *f*-4				Sunshine ... *f*-11 Cloudy ...... *f*-8 Dull ...... *f*-5·6				Sunshine ... *f*-16 Cloudy ...... *f*-11 Dull *f*-8				Sunshine ... *f*-22 Cloudy ...... *f*-16 Dull *f*-11			
AND JULY.	10 a.m to 2 p.m	8 a.m & 4 p.m	6 a.m & 6 p.m	5 a.m & 7 p.m	10 a.m to 2 p.m	8 a.m & 4 p.m	6 a.m & 6 p.m	5 a.m & 7 p.m	10 a.m to 2 p.m	8 a.m & 4 p.m	6 a.m & 6 p.m	5 a.m & 7 p.m	10 a.m to 2 p.m	8 a.m & 4 p.m	6 a.m & 6 p.m	5 a.m & 7 p.m
Sky or Sea ..	$\frac{1}{160}$	$\frac{1}{100}$	$\frac{1}{50}$	$\frac{1}{25}$	$\frac{1}{80}$	$\frac{1}{50}$	$\frac{1}{25}$	$\frac{1}{12}$	$\frac{1}{40}$	$\frac{1}{25}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{20}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$
Panoramic Landscape } ..	$\frac{1}{40}$	$\frac{1}{25}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{20}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{10}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$
Landscape with foreground, Buildings or Portraits	$\frac{1}{20}$	$\frac{1}{12}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{10}$	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{2}{3}$	$\frac{1}{5}$	$\frac{1}{3}$	$\frac{2}{3}$	$1\frac{1}{3}$	$\frac{2}{5}$	$\frac{2}{3}$	$\frac{1}{3}$	$2\frac{1}{2}$

Mr. F. W. Mills.* As rough comparative guides, these tables no doubt have their uses, but it is obvious that their application is not calculated to relieve the photographer of all uncertainty in the matter of exposure. For one thing, they entirely omit at least one vital factor—viz., the speed of the plate. But I quote the table simply for illustrative purposes.

The subject has also been dealt with by Sir David Salomons,† who, it will be seen by the following extract, after incidentally stating his objections to the Royal Photographic Society's lens diaphragm system, gives a series of factors for use in the calculation of exposures. Sir David Salomons remarks:

"The difficulties of exposure may be completely overcome by employing the decimal standard in place of the Photographic Society's standard, which is illogical and inconvenient. The former starts with a standard lens $\sqrt{\frac{f}{10}}$. whose relative exposure is 10 and called Standard 1. The second starts with a lens f-4, whose relative exposure is 16 and called Standard 1. It is evident that division by 10 is far simpler than by 16, for it is effected by simply placing a decimal point, and in all cases of comparison the division must be made. The chief troubles of exposure are removed by marking the stops of all lenses to decimal standard, for there is then no need to tax the memory or make any further calculation. Almost all foreign lenses have their stops marked on the decimal system. Messrs. Dallmeyer were probably the first to use this method. The standard lens is practically Dallmeyer's 2B Patent, which is in the hands of most photographers, and its imitation is probably possessed by those who cannot afford the original. It is therefore fair to assume that no photographer, worthy of the name, exists who does not know the exposure with this lens at open aperture, with a good light indoors and a quick plate. The exposure in a well-lighted studio in summer under these conditions is about one second. We have therefore a foundation to start with, and this one second must be multiplied by the number of the stop used (no matter what lens is employed if marked by the decimal system): also account must be taken of time of year, hour of the day, subject, and plate. For out-of-doors the one second may be replaced by 1-10 second. The following are very simple tables, and complete enough for some of these factors, the assumption being fairly bright weather. If dull, allowances must be made for which no rule can exist, since the circumstances vary so much; but bright clouds and clear sky are about equal in light.

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* *The Photographer's Exposure Book.* By F. W. Mills, published by Dawbarn & Ward Farringdon Avenue, London, W.C.

* *The Photographer's Note Book and Index.* By Sir David Salomons, Bart, M.A. published by Marian & Co., Soho-square

The relative value of the light for the time of year is approximately:

April, May, June, July, August light	1
February, March, September	2
January, October, November	3
December	4

At all times of the year the light is fairly equal from 11 a.m. till 2 p.m.

For relative value of subjects:—

Sea and sky	1
Landscape	4
Dark buildings and foliage	10
Indoor subjects well lighted	30-50
Dark subjects, interiors and dark shadows	100-400

Sir David Salomons then gives the following example of the application of his rule:—

Let stop number be 15.
Let time of year be May—number is 1.
Let light be dull, say ½ if bright—this is therefore 2.
Let subject be exterior of an old farmhouse—number is 10.
Let plate used be ordinary or half most rapid—number is 2.

Then we get for exposure:

1-10 second × 15 × 1 × 2 × 10 × 2 = 60 seconds or 1 minute.

Sir David concludes his reference to the above quoted exposure rule with the remark that since there is a great margin allowable in exposures, this exposure may be halved or doubled without injuring the result. The margin between half a minute and two minutes in exterior work with a dull light is rather wide, and it may be doubted if in practice the range of latitude is so great.

CHAPTER V.

MR. ALFRED WATKINS ON THE ELEMENTS OF PHOTOGRAPHIC EXPOSURE.

IN a little pamphlet entitled "The Elements of Photographic Exposure," and dated 1890, Mr. Alfred Watkins discusses the factors which influence exposure; light, plate, subject, diaphragm, distance. And, as in these notes Mr. Watkins indicates the principles upon which his useful series of exposure meters is based, I make no apology for the fulness of the following quotations:—

A.—The actinic power and volume of light falling upon the worst lighted part of the subject in which detail is required.

Light varies in chemical or actinic power (and this is the quality which concerns a photographer, not merely its brightness to the eye) with every hour of the day and every month of the year, in addition to this the atmospheric conditions—east wind, recent rain, &c.—alter its value. Then the volume of light reaching the subject varies very much, perhaps a large part of it is cut off by overhanging trees or adjacent buildings; or the subject is in a room and only a small proportion of the outdoor light reaches it by means of the window, and here the distance from the window makes an enormous difference in the intensity of the light.

It will be noted that the light to be estimated is that which falls upon the subject, not that which ought to fall upon it according to the time of day, or which would fall upon it if it happens to be out-of-doors.

The definition states that "the light falling upon the worst lighted part of the subject in which detail is required" is what has to be considered the key-note of the exposure; this is simply following out the old golden rule, "expose for your shadows." It must, however, be borne in mind that it is not always possible in practical photography to get the detail in the deepest shadows impressed upon the plate without hopelessly over-exposing for the distance. For instance, in a view including the mouth of a cave, and a bit of distant landscape, it would be absurd to take the light some yards inside the cave as a basis of exposure: the practical limits of photography must be kept in mind.

Again in a sun-lighted landscape, with only small amount of shadow —such as that of hedgerows—the judgment of the photographer will tell him that he will get a more brilliant picture if he ignores these unimportant bits of shadow, and takes the direct sunlight as the basis of his exposure.

P.—The Sensitiveness of the Plate Used.

A practical trial seems to be the best method of getting this information. The Warnerke sensitometer numbers, as given by the makers, are not always to be relied upon, and the terms "30 times," "60 times," &c., are usually most inaccurate and misleading. With some makers it is impossible to rely upon getting plates of uniform sensitiveness. This practical test is all the more necessary, as the "sensitiveness" of a plate in the hands of any worker really includes the method of development he adopts and the class of negative he requires.

S.—The capacity of the subject, or its most non-actinic part for reflecting light to the lens.

Experience teaches that the average exposure suitable for a medium-coloured object is insufficient for a dark terra-cotta bust, and, on the other hand, a white object requires a much shorter exposure in order to render the delicate half-tints; and an object in black and white (pen drawing, engraving, &c.), also requires a short exposure in order that the black part may have no effect upon the plate, hence there must be a variation in exposure to suit the subject.

Great care must be taken not to mix up the question of darkness in lighting (which comes under A) and darkness in the colour or tone of the object itself. A dark object brilliantly lighted may reflect an equal amount of light as a light object badly lighted, but in order to get accurate results the two factors must be kept distinct in the mind. Most exposure tables and several exposure meters have made a terrible muddle on this point. Several instruments are based upon the idea that "an exposure should be in inverse proportion to the amount of actinic light reflected from the subject, or its most non-actinic part." This presumption is an entire fallacy; it would be correct if the object of an exposure were to get an equal deposit or density in the negative for each class of subject, but it need hardly be pointed out that the object of photography is to show correctly the difference in the lightness or darkness of objects.

My system makes a standard of average coloured objects, such as the average in a street view or landscape or portrait; this is valued at 100, and objects or groups of objects, which experience teaches require different exposures, are valued in proportion, darker up to 200, and lighter down to 25.

In landscape, the distant objects (say over 100 yards or so) are best treated with less than the average exposure (see explanation under F), but in nine cases out of ten this shorter exposure cannot be given, as the view generally contains a foreground which has to be the keynote for exposure.

It is in the estimation of subject value that the artistic skill of the photographer comes in; light, plate, and diaphragm can be treated mechanically, the subject cannot.

F.—The Distance of Subject from Lens.

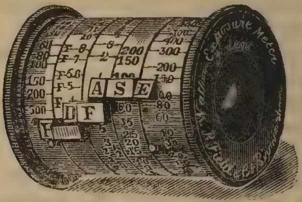
It may be taken as a general rule that, except when photographing near objects (less than 24 times the focus of the lens distant), or on the other hand extreme distance in landscape, no variation need be made for differences in distance.

When a very near object is photographed, the camera has to be racked out, and the exposure increases in proportion to the square of the increased focus of the lens. When the subject is more than 24 times the focus of the lens distant (18 feet for a 9 inch lens) this variation is too minute to be taken into account, and if the air were perfectly clear—as it is sometimes among the Swiss peaks—all objects beyond that distance would require the same exposure. In England, however, the slight fog or mist almost always present in the air, adds reflected light to the image of objects more than one or two hundred yards distant, and thus decreases the exposure (it is impossible to express this by rule, as it depends entirely upon the amount of mist in the air); this shorter exposure cannot often be taken advantage of, as pointed out previously.

CHAPTER VI.

THE WATKINS STANDARD EXPOSURE METER.

This instrument consists of a simple actinometer for testing the light, a chain pendulum for counting seconds or half-seconds (for timing both the actinometer and camera exposures) and five movable calculating rings carrying pointers, P, D, S, F, and A, which, when adjusted to the numbers representing the value of each factor, causes a sixth pointer, E, to indicate the correct exposure. It is a means of calculating variations from one test exposure. The basis of the calculation is a test of the light which is actually illuminating the shadiest part of the subject to be photographed, and the first thing to do, therefore, is to test the light: Unfasten the lid of the pendulum box, and allow it to swing, then hold the actinometer to face the source of the light which falls upon the subject, not to face the subject; pull out a fresh surface of sensitive paper under the aperture, and at the same instant count "nought;" continue counting "one, two," &c., in time with the swing of the pendulum (counting at one end of the swing only for seconds). The number of seconds taken for the paper to darken to the standard tint is the actinometer or A number. In testing the light the depth of tint is the important point. The paper darkens rapidly in light; up to a certain point it is lighter than the standard tint, after this point it is darker. The point when it is neither lighter nor darker is that to be timed.



To Calculate the Exposure.—Set the pointer P to the speed of the plate, D, to the diaphragm used, and A to the actinometer number just observed, taking care that the rings already adjusted are not moved, and the exposure will be indicated by pointer E, if the subject be of the usual average value (100), or if not against the proper subject number. The scale of subject numbers is on the right of the last movable ring. The upper edge of the pointers should be set to the division line. If the exposure is less than a second, E will point to a number with a mark in front which is a vulgar fraction. Thus: '2 is ½, '20 is 1-20th, and so on. The pointers must be moved in the order indicated. In case of a bad light, where the actinometer takes more than a minute to discolour (say three minutes) set A to the number of minutes (3), and read E as minutes instead of seconds. The light which falls upon the worst-lighted part of the subject in which detail is required in the negative is that to be tested. Where full detail is wanted in shadows in out-door work, the direct sun light should not be tested, but the actinometer should point to the sky in a direction at right angles to the sun's rays, which should not fall upon the paper. Where the shadows are not so important, it is a good plan to take the average between the sun light test and the sky test for the A number. It is only when there are no shadows of importance, or in open landscape, that the direct sun light test should be taken for the A number.

Exteriors:—

View under trees or in shady lane—expose actinometer under shade of trees.

Portrait, in or out of doors—expose actinometer in place occupied by sitter.

Sunlit buildings or landscape partly in shadow—expose actinometer in the shadow, or the shade of your own body, if more convenient.

Sunlit landscape or building with no shadow—expose actinometer in sunlight.

Interiors:—

Expose actinometer in the worst-lighted part of the subject, not out of doors.

In order to save the time occupied in testing a weak light, a diaphragm may be used in the lens of such a size that the camera exposure shall be equal to the actinometer exposure, and the light may be tested while the plate is being exposed. The use of the actual tint (the whole tint) makes necessary an inconveniently small stop, and the "quarter tint" is therefore provided. It is marked by a white dot on its face, and brought into use by reversing the tint mask. It is sometimes useful to use even a lighter tint than this, and it is useful to know that the first visible darkening of the paper is equal to a sixteenth tint, as it takes place in one-sixteenth the full actinometer time.

To find the stops required to use with these tints; set P at the plate speed and move D on (with A pointer resting against it at 1) until E points to 1-16 for sixteenth tint; to ¼ for quarter tint, or to 1 if the whole tint is used. D will then indicate the stop to use.

Example:—

With plate speed 120, a stop of *f*-22 can be used in the lens, the actinometer laid down facing the light (not the roof)) in the worst lighted part in which detail is wanted, the lens uncapped and the cap put on again as soon as the paper begins to discolour visibly (sixteenth tint). The discolouration of the paper may be seen by pulling the strip out a trifle for an instant. With the quarter tint and plate 120 the required stop would be *f*-45.

After using the quarter tint it is best to reverse it again before going out of doors. The quarter tint will be found useful for studio and winter work, the value indicated by it being multiplied by four to give the A number for calculation.

The following table shows the stops required with different speeds of plates to make the actinometer exposure and the camera exposure equal with either of the tints; it is presumed that the subject value is 100. This method can also be used for all kinds of out-door work, besides the interiors. For instance, for Ilford Ordinary (35), P32 on the table is near enough, and if a stop of *f*-22 is used, the exposure will always be the same time that is required to discolour the paper to the quarter tint, no calculation with the slide rules being required.

P.	Whole Tint.	Qtr. tint.	$\frac{1}{16}$ tint.
4	*f*-16	*f*-8	*f*-4
6	*f*-20	*f*-10	*f*-5
8	*f*-22	*f*-11	*f*-5·6
12	*f*-28	*f*-14	*f*-7
16	*f*-32	*f*-16	*f*-8
24	*f*-40	*f*-20	*f*-10
32	*f*-45	*f*-22	*f*-11
48	*f*-56	*f*-28	*f*-14
64	*f*-64	*f*-32	*f*-16
96	*f*-80	*f*-40	*f*-20
128	*f*-90	*f*-45	*f*-22
192	*f*-112	*f*-56	*f*-28

The A value used when calculating for cloud negatives should be direct sun light, even if the earth is in shadow at the time.

The Plate Speed numbers must be only regarded as approximate, and a guide to the first trial; for in the first place few makes are always issued at the same sensitiveness; and, in the second place, different workers vary in their method of development, and in their idea of what a negative ought to be. The P number may be regarded as the "regulator" of the instrument, to be set fast or slow according to individual needs. The standard for P1 is that it requires with *f*-8 an equal exposure to the actinometer value of the light.

Subject Number.—This depends on the colour of the subject, or its capacity for reflecting actinic light, without considering, in the slightest degree, what light is falling upon it; for instance, a piece of dark carved oak would be S200, whether it be in full sunshine or in a dark interior. S100 is the standard number used in four cases out of five, and the others may be considered as variations to suit special subjects.

Sky or sea	S10
Snow scenes. White objects in which detail is required or copying black and white (see special table for distance). Extreme distance in landscape. Shipping	S25
Light objects and panoramic or open landscape	S50
Average landscape with foreground, buildings, portraits, and everything of average colour	S100
Very dark or non-actinic objects in which detail is required	S200

THE WATKINS INDOOR METER.

For this little instrument which Mr. Watkins has designed for indoor use with hand cameras he has issued the following instructions: Hold the meter facing the light in position of the subject to be photographed, not where camera is placed. Turn the lid a little to right,

and count seconds until the paper begins to darken past the pale buff tint. This number of seconds will be the right exposure to give. The first darkening of the paper is the point to observe, and, if in doubt, turn the lid a trifle to right and back again. The meter is devised for indoor work: it indicates correctly outside, but usually far too rapidly for observation. In bad evening or winter light it will be found useful out of doors. In dark interiors the time will be minutes instead of seconds, and, to save time, expose with camera and meter simultaneously, and stop exposure when the paper begins to tint. It is presumed that rollable film or a moderately rapid plate (say from 60 to 120 on the Watkins Plate List) is used. For very rapid plates (160 Watkins or over) give half the indicated exposure. For slow plates (say 25 to 50 Watkins) give double indicated exposure.

CHAPTER VII.

THE WATKINS PLATE SPEED LIST.

For some years I have included amongst the contents of my pocket-book one of Mr. Watkins' plate speed cards. For purposes of comparative reference I have so often found it useful in my photographic work that I have sought and obtained the author's permission to reproduce his latest list of plate speed numbers in this Almanac, the readers of which may also find it of service. The list bears date October 25, 1900. Mr. Watkins points out that the numbers are approximate only, and are for use with the Watkins Exposure Meter. They are obtained from tests by him, by the Hurter and Driffield system (H. & D. latest standard pyro soda), checked by landscape tests.

Adams' Tella Film	70
Austin Edwards' Ord Film	20
,, ,, Inst.	60
,, ,, Double Inst.	120
,, ,, Setoloid	60
Autotype Rapid	100
Barnet Ordinary	80
,, Medium	160
,, Ex Rapid	200
,, Rocket	220
Brilliant Ordinary	30
,, Rapid	40
,, Ex. Rapid	45
,, Special Studio	60
Blair Film	100
*Cadett's Plates x 2½	
* ,, Spectrum x 1	
Eastman Film	120
Edwards' Spec. Landscape	20
,, Medium	20
,, Spec. Rap.	30
,, Snap Shot	120
,, Excelsior	100
,, Med. Iso.	40
,, Inst. Iso.	100
,, Snap Shot	120
Fitch Films, Ordinary	30
,, ,, Rapid	40
,, ,, Extra Rapid	120
Gem plates marked correctly with Watkins speed nos.	
Ilford, Ordinary	35
,, Empress	90
,, Chromatic	70
Ilford, Spec. Rapid	200
*Imperial Plates x 1	
Lumiere Ex. Rapid	80
,, Ortho, A. or B.	80
*Marion's Plates x 1½	
Mawson	220
,, Castle	80
,, Electric	150
,, Ortho.	70
Paget XXX	70
,, XXXXX	100
,, Phoenix	70
,, Portrait	70

* These plates are marked with H and D speed Nos., which multiplied by the value opposite each gives the P No. Thus Cadett's marked 100=P 250. Imperial marked 100=P 100. Marion marked 100=P 150.

Sandell, Landscape	15	Warwick, Ord.	60
,, Ord	50	,, Inst.	70
,, Perfect or Sp. Ex.	100	,, Spec. Rap.	80
Thomas, Med. Iso. or Ord.	10	,, D. Inst.	130
,, Ex. Rap. Iso. or Ord.	42	Wellington, Paper or Film	80
,, A1 Iso. or Ord.	120	Wratten, Ordinary	12
,, Bee	60	,, Instantaneous	40
Verel, Ord.	50	,, Drop Shutter	80
,, Spec. Rap.	150	,, Speed	180
,, Runaway	220	Rainbow, Fast	80
		,, Slow	60

PHOTO-MECHANICAL OR PROCESS PLATES.

Ilford	12	Imperial	16
Mawson	8	England	24

AMERICAN PLATES, tested April, 1900.

	P		P
Blair Film	110	Eastman, Film	100
Cramer Banner	80	Excelsior Extra Rapid	180
,, Crown	120	Hammer Slow	45
,, Slow Iso.	80	,, Extra Fast	180
,, Med. Iso.	110	Lovel	120
,, Inst. Iso.	250	New American Film	100
Carbutt B 16	9	New York Crescent	25
,, Eclipse 27	140	,, ,, New Harvard	80
,, Ortho 23	12	,, ,, Record	100
,, ,, 27	140	,, ,, Ortho.	80
Chautauqua	120	Seed 27	150
Eastman, Red	100	Stanley	180

Tested May, 1896.

Climax Extra	120	Weustner Cyclone	150
Weustner New Eagle 40 X	70	,, Ortho	150
,, Imperial Non Hal.	100		

LANTERN PLATES. P NUMBERS.

Thomas	2	Edwards' Spec.	3
Ilford Spec.	6	Hill Norris Col.	8
Eastman	6	Carbutt A	18
Cadett	3	Paget Rapid	5
Imperial Spec.	15	,, Slow	6
,, Slow	4	Cowan Chloro-bromide	8
Barnett	12	Queen	2
Mawson	2	England Rap. chloride	2
Sandell	4	Beernaert (Chloride)	¼
New York	6		

BROMIDE PAPERS.

Eastman Permanent Slow	6	Barnet Platino-bromide	12
,, Hard Enamel	6	Morgan & Kidd	20
,, Ex. Rapid	15	Anthony Rapid	50
,, Soft Enamel	20	Eastman's Transfero	6
,, Platino-Bromide	15	Ilford Slow	4
Lumiere, Rap.	14	,, Rapid	35
Velox	1/100	Dr. Just	4
Special Velox	1/10	Paget	9
Edwards' Excel.	20	Wellington	15
Marion	6	Rotograph	25

CHAPTER VIII.

THE ILFORD EXPOSURE METER.

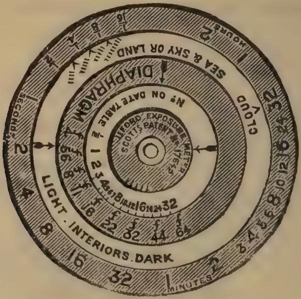
This instrument, which was devised by Professor J. A. Scott, of Dublin, consists of three movable circles or discs, which revolve freely on a central axis, to which axis is fixed two circular plates, one forming the centre of the front, and the other the back of the instrument. These circles are named from the figures or subjects engraved upon them, in order as follows:—

Central.—	Plate circle	Fixed.
,,	Date circle	Movable.
,,	Diaphragm circle	,,
,,	Subject circle	,,
Outside.—	Exposure circle	Fixed.

The Plate Circle gives the comparative rapidity of the sensitive plates. The initials represent the following:—

Special Rapid	S.R.
Empress	E.
Ordinary and Iso.	O. and I.

The Date Circle contains only numbers between ½ to 32, these numbers being those found engraved on the back of the instrument in the table giving the months and hours. It gives the intensity of the sun's light at the various times marked on it, and will remain correct if the sun's disc be not actually obscured by clouds. It is important to remember that the figures are calculated on the assumption that the



sun is shining, and that it is visible either at the particular spot where the camera is placed or somewhere near. Thus, a group may be photographed in the shade of a house, and if the sun is shining as above, the figure in the table should be used without modification.

The only correction necessary is on a cloudy or rainy day. If the sun be covered by clouds, or the sky be generally overcast, or two large clouds passing the sun, multiply by two. If dull or gloomy, or light rain, multiply by three or four, and take the product as the "date number" to be used.

The Diaphragm Circle gives the stop used.

The Subject Circle gives the principal classes of subjects photographed. As the names are somewhat contracted, the following table will explain:—

Clouds.—Cloud studies with little or no relation to landscape.

Sea and Sky.—Such as yachting pictures or well-lighted coast scenes.

Open Landscape.—Distant views with very little, or a strongly lighted foreground.

Buildings.—Includes any well-lighted foreground study which is not of dark colour, and has not very deep shadows.

Groups.—These are supposed to be in the shade, protected from the actual rays of the sun.

Foreground.—Heavy or dark foliage foreground studies.

Dark Interior—

Light Interior—

The Exposure Circle gives the time of exposure in fractions of a second, in minutes, or in hours, as the figures occur over one or other of these words.

To Use the Ilford Exposure Meter.—(1) Place the arrow on the Date Circle opposite the mark representing the plate which you are using. (2) Place the arrow on the Diaphragm Circle opposite the number representing the date and hour when you are photographing. (3) Place the arrow on the Subject Circle opposite the stop you are using. (4) Then opposite the several subjects will be found the exposure to be given.

CHAPTER IX.

VARIATIONS OF LIGHT VALUES IN DIFFERENT LATITUDES.

Supplementing Dr. Scott's table, applicable to the British Isles, I append, by permission of the Britannia Works Company, the tables for other latitudes which are to be found in the little book relating to the Ilford Exposure Meter referred to above.

TABLE I.—For Countries about Latitude 60°

(Norway, &c.)

A.M.	P.M.	June	May July	April Aug.	Mar. Sep.	Feb. Oct.	Jan. Nov.	Dec.
12		1	1¼	1¼	1¾	2¼	2¼	3½
11	1	1	1¼	1½	1¾	2¼	3	8
10	2	1¼	1¼	1½	2	2½	4	14
9	3	1¼	1½	1¾	2¼	3½	7	
8	4	1½	1¾	2¼	3½	6		
7	5	2	2½	3½	6			
6	6	2½	3½	6				
5	7	4	8					
4	8	7						

TABLE II.—For Countries about Latitude 53°

(British Isles, North Germany, Canada, &c.)

A.M.	P.M.	June	May July	April Aug.	Mar. Sept.	Feb. Oct.	Jan. Nov.	Dec.
12		1	1	1¼	1½	2	3½	4
11	1	1	1	1¼	1½	2½	4	5
10	2	1	1	1¼	1¾	3	5	6
9	3	1	1¼	1½	2	4	12	16
8	4	1½	1½	2	3	10		
7	5	2	2½	3	6			
6	6	2½	3	6				
5	7	5	6					
4	8	12						

TABLE III.—For Countries about North Latitude 40°.

(United States, Armenia, Spain, Italy, Japan.)

A.M.	P.	June	May July	April Aug.	Mar. Sep.	Feb. Oct.	Jan. Nov.	Dec
12		1	1	1	1	1¼	1½	2
11	1	1	1	1	1¼	1¼	1½	2
10	2	1	1	1¼	1¼	1½	1¾	2½
9	3	1¼	1¼	1¼	1½	2	2½	3½
8	4	1½	1½	1¾	2¼	2¾	4	8
7	5	2	2½	2¾	4	7		
6	6	3½	5	8				
5	7	9						

TABLE IV.—For Countries about North Latitude 30°.

(China, Egypt, Southern States, U.S.A.)

A.M.	P.M.	June	May July	April Aug.	Mar. Sep.	Feb. Oct.	Jan. Nov.	Dec.
12		¾	1	1	1	1	1¼	1½
11	1	1	1	1	1	1	1¼	1½
10	2	1	1	1	1	1¼	1½	2
9	3	1	1	1¼	1¼	1½	1¾	2½
8	4	1½	1½	1¾	2	2¼	3	5
7	5	2	2½	2¼	3½	6	9	
6	6	6	8	14				

TABLE V.—For Countries about North Latitude 23°

(India, Mexico.)

A.M.	P.M.	June	May July	April Aug.	Mar. Sept.	Feb. Oct.	Jan. Nov.	Dec.
12		¾	¾	¾	1	1	1	1¼
11	1	1	1	1	1	1	1¼	1¼
10	2	1	1	1	1	1¼	1¼	1½
9	3	1¼	1¼	1¼	1½	1½	1¾	2
8	4	1½	1½	1½	1¾	2	2¼	3
7	5	2¼	2½	2¾	3½	4	6	15
6	6	6	7	12				

TABLE VI.—For Countries near the Equator

(British Guiana, N. Brazil, Central Africa, Sumatra, Borneo, &c.)

A.M.	P.M.	June Dec.	Jan. May July Nov.	Feb. April August Oct.	March Septr.
12		1	1	¾	¾
11	1	1	1	1	1
11	2	1	1	1	1
9	3	1½	1¼	1¼	1¼
8	4	2	1¾	1¾	1¾
7	5	3½	3½	3	3

TABLE VII.—For Countries about South Latitude 23°.

North Australia, Madagascar, Southern Brazil (Rio Janeiro.)

A.M.	P.M.	Dec.	Nov. Jan.	Oct. Feb.	Sept. Mar.	Aug. April	July May	June
12		¾	¾	¾	1	1	1	1¼
11	1	1	1	1	1	1	1¼	1¼
10	2	1	1	1	1	1¼	1¼	1½
9	3	1¼	1¼	1¼	1½	1½	1¾	2
8	4	1½	1½	1½	1¾	2	2¼	3
7	5	2¼	2½	2¾	3½	4	6	15
6	6	6	7	12				

TABLE VIII.—For Countries about South Latitude 30°.

(South Australia, Cape Colony, Argentine Republic, &c.)

A.M.	P.M.	Dec.	Nov. Jan.	Oct. Feb.	Sept. Mar.	Aug. April	July. May	June
12		¾	1	1	1	1	1¼	1½
11	1	1	1	1	1	1	1¼	1½
10	2	1	1	1	1	1¼	1½	2
9	3	1	1	1¼	1¼	1½	1¾	2½
8	4	1½	1½	1¾	2	2¼	3	5
7	5	2	2½	2¾	3½	6	9	
6	6	6	8	14				

TABLE IX.—For Countries about South Latitude 40°.

(Australia, Melbourne, New Zealand, &c.)

A.M.	P.M.	Dec.	Nov. Jan.	Oct. Feb.	Sep. Mar.	Aug. April	July May	June
12		1	1	1	1	1¼	1½	2
11	1	1	1	1¼	1¼	1¼	1½	2
10	2	1	1	1¼	1¼	1½	1¾	2½
9	3	1¼	1¼	1¼	1¼	2	2½	3½
8	4	1½	1½	1¾	2¼	2¾	4	8
7	5	2	2½	2¾	4	7		
6	6	3½	5	8				
5	7	9						

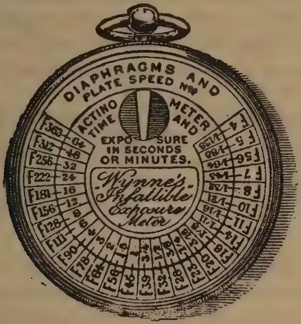
CHAPTER X.

THE WYNNE METER.

OF the four conditions governing exposure, light, diaphragm, character of subject and plate sensitiveness, two, the first and fourth, need only be considered in relation to the "Infallible" Wynne meter. I condense from the explanatory pamphlet sent out by Mr. Wynne the essential details relating to those two conditions, together with descriptive matter sufficient to indicate how the conditions are made use of in the instrument itself, and the manner in which the latter is employed in estimating exposures:

The intensity of the light is determined by the time, in seconds, taken for the sensitive paper in the actinometer to colour to a standard tint. This in the open varies from about 2 or 3 seconds in brilliant summer light to 2 or 3 minutes at sunrise and sunset, and is called the actinometer time. There are two tints in the actinometer, the darker one or standard tint being used for all ordinary subjects and conditions, and the lighter one for interiors, views under trees, or when the light is very weak and takes minutes to colour the paper to the standard tint. It is suggested that if the actinometer is held in the shadow of the body the light value in that position will be the same as if held in the shadow of the subject being photographed. In order to expose a fresh surface of sensitive paper, the photographer is directed to turn the milled edge of the instrument a distance of about $\frac{1}{8}$ of an inch to the right or left until a fresh white surface of paper is seen through the aperture, and then to place the thumb over it until ready to measure the time it takes to colour to the standard tint, before explained. To the meter is affixed a yellow glass disc, the use of which is thus explained:

When a fresh surface is required, the glass is turned until the shutter covers the sensitive paper, which can then be turned the requisite distance by observing its movement through the yellow glass, which at the time protects it from the action of the light. The exposure of the paper can then be made at any time by simply turning the glass and shutter attached thereto.



The Sensitiveness of the Plate.—Instead of expressing the sensitiveness of a plate by an arbitrary number, it is expressd on the Wynne meter by the size of diaphragm through which the plate would require the actinometer time for its correct exposure upon a normal subject. Thus Ilford Ordinary plates, No. *f*-45, means that an ordinary subject upon these plates, through stop *f*-45, would require the actinometer time for its correct exposure. Similarly—

Mawson's Photo Mechanical Plates	No. *f*-14
Wratten's Ordinary Plates	No. *f*-28
Paget XXXXX Plates	No. *f*-101
Imperial Rapid	No. *f*-78

means that each of these plates would require the actinometer time for its correct exposure upon a normal subject through the diaphragm which represents its speed number as above.

If the scales of the instrument are placed in their normal position, as in the illustration, *f*-45 (which is the average speed of an ordinary plate) will stand opposite to 1, and the comparative speed of any plate will then be simultaneously found opposite the diaphragm number, thus:—

	Diaphragm Speed No.	Comparative Speeds.
Paget Phœnix	*f*-45	1
,, XXX	*f*-64	2
Lumiere Ex Rapid	*f*-90	4
Sandell Special Express	*f*-78	3
Barnet Studio	*f*-56	1½
Wratten Ordinary	*f*-28	⅜

To Calculate the Correct Exposure.—Turn the glass carrying the movable scale of the instrument until the actinometer time in seconds upon the exposure scale is opposite the diaphragm number of the plate. Then the correct exposure in seconds and fractions of seconds will be found simultaneously against each stop from the largest to the smallest.

The following examples are given in the pamphlet from which I am quoting:—

No. 1.

Plate No.	*f*-45.
Actinometer	12 seconds.
Stop	*f*-16.

Put 12 seconds against *f*-45. Then against *f*-16 will be found 1½ seconds, which is the correct exposure, and also against every other stop the correct exposure for that particular diaphragm.

No. 2.

Plate No.	*f*-90.
Actinometer	3 seconds.
Stop	*f*-5.6

Put 3 seconds against *f*-90. Then against *f*-5.6 will be found 1-85th of a second, and also against every other stop the correct relative exposure. If an interior exposure or an exposure in a shaded situation the sensitive paper takes minutes instead of seconds to colour to the standard tint, the figures upon the exposure scale may be read as minutes instead of seconds.

LIST OF PLATE SPEEDS FOR USE WITH THE WYNNE METER.

Adams' Tella Films	F111
A. Perron Extra Rapid	F 45
Austin Edwards Ordy	F 45
,, ,, Inst.	F 78
,, ,, Double Inst.	F101
,, ,, Setoloid Film	F 78
Autotype Rapid	F 90
Barnet Ordinary	F 56
,, Studio	F 56
,, Extra Rapid	F 90
,, Rocket	F101
Beernaert's Ordinary G	F 45
,, Extra Rapid A	F 64
,, Rapid B	F 56

Brilliant Ordinary	F 56
,, Spec. Studio	F 64
,, Ex. Rapid	F 78
Blair Film	F 56
Dr. Smith Ex. Rapidity	F 90
,, Instantaneous	F 56
,, Ordinary	F 32
,, Orthochromatic	F 16
Eastman Film	F 78
Edwards' Spec. Landscape	F 28
Edwards' Medium Iso.	F 45
,, Ex. Rapid	F 64
,, Snap Shot	F 90
Edwards' Snap Shot Iso.	F 78
Fitch Films Ordinary	F 56
,, Rapid	F 64
,, Sp. Ex. Rapid	F 90
Gem Universal	F 56
,, Meteor	F 90
,, Portrait	F 78
,, Process	F 28
Graffe & Jougla Ex. Rap.	F 54
,, ,, Inst.	F 78
Griershabr Ex. Rapid	F 64
Guillimenot	F 78
Hill Norris, Col. Med.	F 14
Ilford Ordinary	F 45
,, Empress	F 64
,, Spec. Rapid	F111
,, Half Tone	F 32
,, Medium Iso.	F 45
,, Photo Mechanical	F 41
Lumiere Rapid	F 64
,, Extra Rapid	F 90
Mawson	F101
,, Castle	F 56
,, Ortho.	F 64
,, Photo Mechanical	F 16
,, Electric	F 78
,, Half Tone	F 28
Mawson Lantern	F 20
Monckhoven Ex. Rap.	F 90
Paget XXX	F 64
,, XXXXX	F101
,, Phœnix	F 45
,, Special Rapid	F 64
Premier Ordinary	F 39
,, Studio	F 45
,, Extra Rapid	F 90
Sandell Perfect	F 78
,, Landscape	F 28
,, Ordinary	F 56
,, II., III. or Sp. Ex.	F 64
Thomas Med. Ord. and Iso.	F 39
Thomas A1 Ord. and Iso.	F 90
,, Ex. Rap. Ord. and Iso.	F 64
Verel's Cathcart Sp. Rap.	F101
,, Ordinary	F 64
,, Runaway	F111
Warwick Ordinary	F 56
,, Inst.	F 64
,, Double Inst.	F111
Wellington & Ward Neg. Paper	F 64
Wratten, Ordinary	F 28
,, Speed Plate	F 90
,, Drop Shutter	F111
,, Double Inst.	F111

SPEEDS OF AMERICAN PLATES.

Carbutt's Gelatino Albumen Transparency	F 8
Carbutt's Keystone A	F 11
,, ,, B	F 32
,, New Process	F 11
,, Special No. 25	F 50
,, Eclipse S. 27	F 78
,, Ortho. Portrait	
,, ,, S. 23	F 39
,, ,, S. 27	F 50
,, Non Halation	F 64
Cramer's (Cr. Lighting)	F 90
,, Transparency	F 23
,, Banner Lighting	F 78
,, Isochromatic	
,, Medium	F 56
,, ,, Instants	F 90
Blair's Film, 25	F 56
Record Dry Plate R	F 64
Record Dry Plate M	F 50
,, ,, S	F 45
Forbes' Landscape	F 56
,, Transparency	F 45
,, Instantaneous S	F 90
Hammer Ex. Fast	F 90
,, ,, Double Coated	F101
,, Special	F 90
N. York N. Harvard Rap.	F 39
,, Record Ex. Rapid	F 64
Seed, No. S. 23	F 64
,, Extra Rapid S.	F 90
,, ,, No. 27	F 90
Standard, S. 50	F 64
,, Ex. Rapid	F 56
Stanley, S. 35	F 64
,, S. 50	F 90
Wuestner's Non-Halation Inst. Ortho.	F 56

Cadett, Imperial and Marion Plates have Speed Nos. marked on Boxes—the relative F Nos. being as follows :—

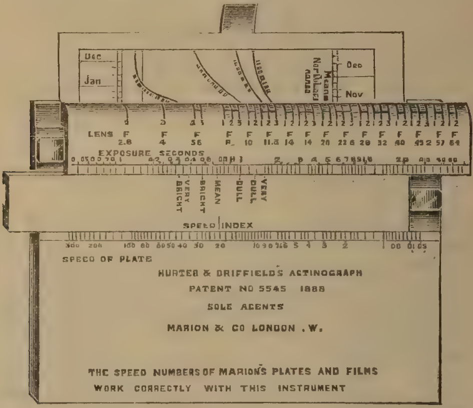
Speed Nos. on Boxes.	20	30	40	60	80	120	160	240	320
	F	F	F	F	F	F	F	F	F
Imperial	28	32	39	45	56	64	78	90	111
Marion	32	39	45	56	64	78	90	111	128
Cadett	39	45	56	64	78	90	111	128	156

CHAPTER XI.

THE HURTER AND DRIFFIELD ACTINOGRAPH.

The Actinograph consists of four scales which correspond respectively with the light, the lens, the exposure, and the speed of the plate.

The Light is indicated on the sliding scale at the back by means of curves for every day of the year, and for every hour of the day when it is photographically active.


Dec
Jan
Dec
Nov
Mean
LENS F 2.8 F 4 F 56 F 8 F 10 F 11.3 F 14 F 14 F 20 F 22 6 F 28 F 32 F 40 F 45 2 F 57 F 64
EXPOSURE SECONDS
VERY BRIGHT
BRIGHT
MEAN
DULL
DULL
VERY
SPEED INDEX
SPEED OF PLATE
HURTER & DRIFFIELD'S ACTINOGRAPH
PATENT NO 5545 1888
SOLE AGENTS
MARION & CO LONDON . W.
THE SPEED NUMBERS OF MARION'S PLATES AND FILMS
WORK CORRECTLY WITH THIS INSTRUMENT

The Lens Scale on the upper edge of the top slide shows the ratios of aperture to focal length in general use. There are three marks to each ratio of the system advocated by the Photographic Society of Great Britain. These three marks, 1, 2, and 3, correspond respectively to single lenses, doublets, and triple combinations.

The Exposure Scale on the lower edge of the top slide indicates exposures ranging from 1-20th of a second to one minute.

The Speed Scale.—The speed of the plates as marked on this scale refers to the Hurter and Driffield system only. Sliding between the speed and exposure scales is another slide. Upon the upper edge of this slide are five points, pointing simultaneously to five different times of exposure. The five points are marked with the words "Very bright," "Bright," "Mean," "Dull," and "Very dull," and the exposure must be selected opposite that point which most nearly corresponds with the atmospheric conditions at the time of exposure. The selection of the right point to use presents no difficulty in our definition if a "mean" light be borne in mind. A "mean" light is indicated when there is just sufficient sun to cast a very faint shadow.

An example for the use of the Actinograph to find the exposure for an ordinary landscape is appended:—

Data given.	Day	7th October.
	Hour	4 p.m.
N. Lat. 52° 30′	Lens and Stop ...	Doublet F-22.6.
	Speed of Plate ...	15.
	Light	"Very bright."

(1) Slide upwards the Light scale until the date October 7 is level with the edge of the lens scale.

(2) Set the "speed index" to 15 on the speed scale.

(3) Move the top side until the point marked *f*-22.6 (2) coincides with the curve on the Light scale marked 8 a.m. and 4 p.m.

The exposure to be given will now be found opposite the point marked "very bright," viz., 2 seconds.

CHAPTER XII.

EXPOSURE NOTES WITH THE ACTINOGRAPH.

THE author of the Hurter and Driffield Photographers' Note-Book* gives a typical table of data for use with the actinograph, which, with some explanatory notes, may be quoted here. He points out that the exposure which the Actinograph gives is that which will be the least that is necessary for correct exposure when the subject is an "ordinary" landscape. This exposure, which for convenience may be called the normal exposure, is increased or diminished by multiplying or dividing it by certain factors which give the least exposure, which will be correct for subjects varying from the "ordinary" landscape. For instance: "Suppose that the Actinograph gives one second as the correct exposure for an ordinary landscape (this is the normal exposure), and this is the subject you are

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* Published at 26, Albert-street, Manchester.

THE ACTINOGRAPH EXPOSURE TABLE.

Date.	Plate No.	SUBJECT.	Hour.	Plate	D & S	Light	Stop	e	×	E	
1898 Mar. 25	1	Open landscape near ———	2-30	Cadett's ordinary	F. Oxt. 25	mean	f 11	·28		·28	
	2	Clouds	2-45	do.	do.	bright	f 22	·9	·1 (=$\frac{1}{10}$)	·09	
									5	·45	(5 for yellow screen.)
,, 25	3	Old house near ———	4-0	do.	Velox 120	do.	f 16	·14	3	·42	
		Dark shrubs, &c. in foreground									
,, 26	6	*Copying* water-colour drawing	11 a. m	Cadett's Spectrum	Velox say ·5	dull	f 6 *=f 8·5 *(Camera racked out)	10″	20	200	(20 for chromate filter.)
		Some dark colours							2	400	(2 for dark colours.)
									4	1600	=27′. (4 for enclosed court-yard in which photo. was taken.)
May 20	1	Cows grazing	10-0	Cadett's ordinary	Velox 120 F	very bright	f 8	·01	2	·02	
June 1	2	Interior of———church	3-0	do.	Velox 120	mean	f 16	·09	1000	90″	=1′ 30″

D=developer. S=speed No. of plate for that developer. e=exposure shown by Actinograph. × =the factor by which e is to be multiplied. E=the actual exposure to be given.

about to photograph, and there are dark objects in the near foreground, you would take a factor, say, of 2, and, multiplying the 1 second by 2, you get 2 seconds as the correct exposure for that particular subject. Again, supposing you are taking a photograph of a distant landscape, you would divide the 1 second by, say, 2, and the correct exposure would be half of a second. Or, again, supposing that you are photographing a well-lighted interior, you would multiply the normal exposure by, say, 300, giving you 300 seconds, or 5 minutes. It is important that the definition of an "ordinary" landscape should be clearly understood, otherwise there will probably be a tendency to bring factors into use when there is not the slightest occasion to do so. An "ordinary" landscape embraces a much wider range of subjects than it might be supposed to do, and includes all subjects which receive their illumination from the open sky. On the one hand, it is only necessary to increase the exposure if there is a dark object or shadow within a distance from the camera of, say, 20 to 30 times the focal length of the lens used; and, on the other hand, it is only necessary to reduce the exposure when the object of interest is in the extreme distance, and when the immediate foreground is devoid of any dark object and illuminated by the open sky. In these cases, respectively, it is very seldom that the exposure requires more than doubling or less than halving. In the case of pictures taken under trees, the light may be so excluded as to bring such subjects under the conditions of interiors, when a much larger factor will be required, and it is in dealing with abnormal cases of this kind that such a note-book as this will be found of great value in working with the Actinograph. With regard to the use of factors for interiors, 300 may be taken as the factor for a fairly-lighted sitting-room, while a church may require a factor of from 1000 to 5000. Several examples are here given, and one rather exceptional case in which the method of arriving at the necessary exposure is shown in three stages, separate factors being noted to meet the several exceptional conditions."

CHAPTER XIII.

COMPARISONS OF EXPOSURE TABLES.

MR. Charles Louis Hett contributed the following article on this subject to THE BRITISH JOURNAL OF PHOTOGRAPHY:—

There is a very good opening for a series of articles on the speed scales now in use. I have computed the enclosed comparative table, which is as near as I can get it from the data before me; but such data are not always of a satisfactory nature. The following is a quotation from the "Instructions for the Use of Hurter and Driffield's Actinograph."

"The Speed Scale.—The speed of the plates as marked on this scale has no relation to the arbitrary and unreliable speeds generally spoken of, but is based upon scientific principles and upon clearly defined units. We define the speed of a plate as that exposure, expressed in seconds, which, with one actinograph degree of light, will produce a theoretically perfect negative of an ordinary landscape, the light reaching the plate being equal to that reflected by the objects. The marking of plates with their actinograph speed will be a very great boon to photographers, if only because the exposures the plates will require will be exactly proportional to the speed indicated."

The above appears to be very clear and rational, and I understand from it that, if a packet of plates marked 10 required one second exposure, another marked 20 required two seconds, and so in proportion; but all this is expressed by the example which is given thus:—

"If, for example, a photographer has worked successfully with some plates of which the actinograph speed was 10, and the next packet he procures is marked 20, he will at once know that the latter requires just half the exposure of the former, because twice as rapid."

EXPOSURE TABLE.

Proportionate length of Exposure.	Hurter & Driffield's Notation.	Watkins' P number.	Wynne's Meter.
6	166·6̈6	250	*f*-115
7	143	214	*f*-106
8	123	188	*f*-99
9	111·1̈1	166·6̈6	*f*-94
10	100	150	*f*-89
20	50	75	*f*-63
30	33·3̈3	50	*f*-51
40	25	37·5	*f*-45
50	20	30·0	*f*-40
60	16·6̈6	25·0	*f*-36
70	14·3	21·4	*f*-34
80	12·5	18·8	*f*-32
90	11·1̇11̇	16·6̈6	*f*-30
100	10	15	*f*-28

This is difficulty No. 1. The scale used in the Watkins' meter is clear, and the column of proportionate exposure is calculated to correspond with it.

Returning to the Hurter and Driffield meter, I find, from Mr. Watkins' Relative Speed List, that some firms mark their plates with H. and D. speed numbers, but that the speeds denoted by the same number vary according to the make as 1 to 1½ and 2½ (approximately). This difference, I understand, is due to the developer used in testing the speed. In compiling the table I have taken the value of the H. and D. meters at two-thirds of the Watkins' plate-numbers. The last column is calculated from the H. and D. column in accordance with the data given in Mr. Wynne's List of Plate Speeds.

Ought not this matter to be taken in hand by the Royal Photographic Society, and a uniform system of testing and marking recommended? My own view is that the numbering should be in direct (not reverse) proportion to the exposure required. This has been done in the case of apertures.

M. Georges Fernau also wrote: Following Mr. Hett's footsteps, I have constructed the table, as under, on a somewhat different basis to his, having aimed at showing, at a glance, by the actual working of the respective light meters, that all comparative terms indicated are in strict relation to each other, their concordancy being established in the table on only one term of diaphragm and one actinometric term of light for every case tested; but the same correctness and corelation exists for all other factors, and thus renders useless more numerous terms of comparison.

Let us take, for instance, Wynne's F plate speed 39, with *f*-32 diaphragm and 3 seconds actinometer light, and the meter will show—

F 39—3
F 32—2,

2 seconds being, in this case, the correct time of exposure.

Compare this now with Watkins' system. To Wynne's *f*-39 speed, the corresponding Watkins' P speed is 24, and we establish the following meter indications:—

P 24 first ring,
D 32 second ring,
A 3=E 2 third ring,

or 2 seconds exposure as in Wynne's instrument, any other terms of comparison giving similar results.

To the following table I have appended several explanatory remarks to make it thoroughly intelligible.

Comparative Table of Figures expressing the speed of plates according to Wynne's and Watkins' principles and instruments with actual times of exposure of such figures in relation to *f*-16 diaphragm top light, the side light being practically stopped off. Another advantage of the carbon process is that no dark room is necessary, as all the operations, from beginning to end, can be carried out in the light of an ordinary room.

The beginner will do well to purchase his tissue ready sensitised, as by so doing he saves himself trouble, and at the same time ensures having it in good condition. There are cases, however, when it will be to the advantage of the amateur to sensitise his own, for, as a rule, his negatives are not all of the same character. Some may be thin and feeble, while others are just the reverse, having excessive contrasts. Now, by sensitising one's own tissue the user has the means of so modifying its character that harmonious prints may be obtained from hard negatives, and vigorous ones from feeble negatives. The stronger the sensitising solution is the softer will be the resulting prints, and, conversely, the weaker it is the greater will be the contrast. It is not necessary, however, to have baths of different strengths to obtain these advantages, for a longer immersion of the tissue in a solution of medium strength secures the same end as immersing it for a shorter time in a stronger one. On the other hand, a short time in the solution is equivalent to employing a weaker bath. The longer the tissue is in the solution the more of it the gelatine absorbs; so that, in practice, a longer time in the solution becomes equivalent to using a stronger bath, and a short time a weak one.

The sensitising is a very simple matter when done on an amateur scale. All that is necessary is to immerse the tissue in the solution of bichromate of potash for the necessary time, according to the character of the negatives to be printed from, and then squeegee it, face downward, on a ferrotype or ebonite plate, and allow it to dry thereon. In the squeegeeing, if the tissue is for hard negatives, it should be lightly done, so as not to remove too much of the solution; if, on the other hand, it is for flat ones, it should be more heavily done, so as to remove more of the bichromate. When dry, the tissue is stripped off, and it is ready for use. The plates, with the tissue upon them, may be put leaning against the wall—tissue next it—of an ordinary room to dry. The plate protects the front of the tissue from light, and the paper on the back, by reason of its non-actinic colour, from the bichromate, is a sufficient protection from the faint light that reaches it from behind. When dried in this way, the surface of the tissue is protected from light dust, and any injurious fumes while drying, and when stripped off the plates it is perfectly flat.

The sensitising can be done in broad daylight, as it is a property in carbon tissue that it is quite insensitive while wet. For this reason the mounting of the exposed tissue on its support for development can be done in open daylight. The only precaution to be taken is that the face of it is not exposed to light until it is in the water. By always keeping it face downward the tissue can be cut to size, and the printing frames filled in an ordinary lighted room, as the paper backing is a sufficient protection in a faint light.

I think that in the foregoing I have shown that the carbon is the most simple process that the amateur can employ. Space will not allow me to dilate on its other advantages.

CYANOTYPE LANTERN SLIDES.

By Geo. W. Valentine.

To be successful in making green or blue lantern slides one must have a large and well-ventilated drying box, and at the same time perfectly light-tight; a levelling slab will be required, set true, horizontally. Coat plates (thoroughly well clean and warmed before coating) with Nelson's gelatine, dilute solution warmed, set on slab to set, and dry in drying box away from dust—the greatest enemy.

Green Slides.

1	Citrate of ammonia and quinine	¾ ounce.
	Distilled water	1 ounce.
2	Red prussiate potash	1 ounce.
	Distilled water	1 ounce.

It is advisable not to mix the above solutions together all at once, for they rapidly deteriorate. A lesser quantity of each can be made, so long as the relative proportions of each are duly kept. Coat with a broad camel's-hair brush—not too much solution in the brush at one time. Brush once horizontally and once vertically only, and set away at once in drying box. When dry, print out behind a good negative (not too dense), and wash in thoroughly clean porcelain dishes, being particular to keep all alkalies entirely at a distance, otherwise the colours will not be kept. For blue slides, use the ordinary ferri-prussiate and ammonia-citrate of iron process, taking the same particular care as for the above; same quantities. The above answers as well for well sized paper. A well fixed and thoroughly well washed gelatine plate will do to experiment with; if any hypo is left in the plate it will not have the blue and green tints.

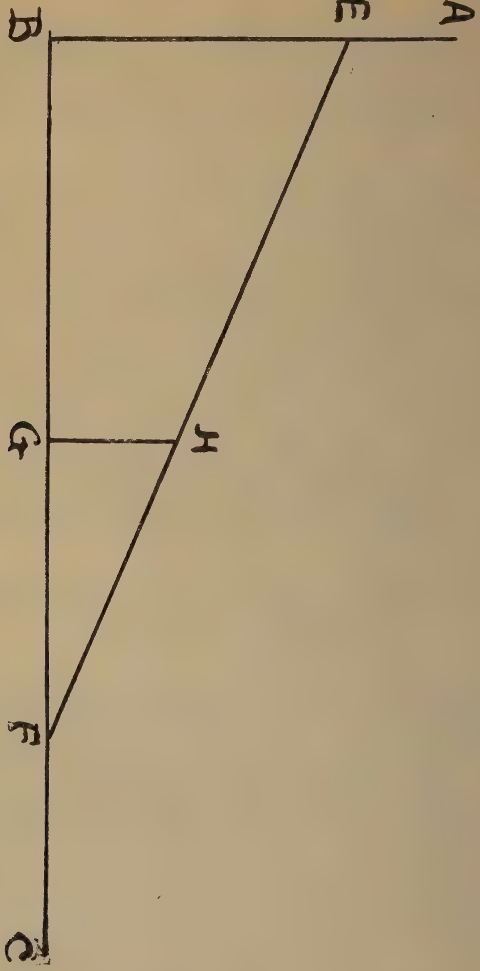
THE DETERMINATION OF FOCAL CONJUGATES BY GEOMETRICAL CONSTRUCTION.

By Thomas Bolas, F.C.S., F.I.C.

The Rev. F. C. Lambert's recent communication to the Royal Photographic Society has created a renewed interest in this subject, already worked out to some extent by R. H. Bow 35 years ago: this gentleman being, as far as I know, the pioneer (see The British Journal of Photography 1865, p. 608). Subsequently Grubb, Lyonel Clark, and others have followed up the subject, but from the point of view of many photographic practitioners I think the most convenient plan is Mr. Lambert's, with a diagonal graduated to show the focal length of the required lens, and a broomstick as parallel ruler.

I suggest the following as a simplification likely to be useful in certain cases; this construction having the advantage of extending over a smaller area than those hitherto proposed, and if the edges of the work bench are graduated as suggested, the device is always ready, and the bench need not be altogether cleared in ordinary cases, as no parallel ruler or long straight edge sweeps over it. The square used may have a short blade, as the length used will always be less than the focal length of the lens.

Graduate two sides of the work bench B A and B C: the scale on B A being never required longer than the equivalent focal length of the longest focal length to be used.



To Find the Shorter Conjugate.—On B A set off B E, equal to the equivalent focal length of the lens. On B C set off B F of such a length that B F, together with B E, shall make up the longer conjugate. Join E and F; a thread stretched between two pins being the most convenient method. Set off F G, equal to B E, and erect the perpendicular G H. The required conjugate will be B E added to G H.

To Find the Longer Conjugate.—Hinge the thread at E, and on a T-square set off G H, equal to the shorter conjugate, less the equivalent focal length. With the other end of the thread find the point F. Then B E added to B F will give the longer conjugate.

COMPARATIVE VALUES OF WYNNE, WATKINS', AND HURTER AND DRIFFIELD'S PLATE, FILM, AND PAPER SPEED SYMBOLS.

By George Fernau.

Table A.			Table B.		
Wynne. F.	Watkins. P.	Hurter & Driffield.	Watkins. P.	Wynne. F.	Hurter & Driffield.
n	*o*	*p*	*x*	*y*	*z*
*5·66		*0·40	1	8	0·80
7		0·61	2	11·31	1·60
*8	*1	*0·80	3	13·86	2·40
10	1·56	1·25	4	16	3·20
*11·31	*2	*1·60	6	19·60	4·80
14	3·06	2·45	8	22·62	6·40
*16	*4	*3·20	10	25·30	8
20	6·25	5	15	30·98	12
*22·62	*8	*6·40	20	35·78	16
28	12·25	9·80	30	43·80	24
*32	*16	*12·80	40	50·59	32
39	23·77	19·01	60	62	48
*45·25	*32	*25·60	80	71·54	64
56	49	39·20	100	80	80
*64	*64	*51·20	150	98	120
78	95·06	76·05	200	113·14	160
*90·50	*128	*102·40	300	138·57	240
111	192·52	154	400	160	320
*128	*256	*204·80			
156	380·25	304·20			
*181	*512	*409·60			

Remarks.—Table A.—In first column (*n*) are given all *f*-plate, film, or paper speed symbols marked on Wynne's exposure meter from f 5.66 to f 181. The figures marked with an asterisk establish a geometrical speed progression with 2 as a common ratio. Thus f 8 represents only half the speed value of f 11.31 as, similarly, f 32 signifies only half the speed value of f 45.25. In second column (*o*), representing the conversion from Wynne's into Watkins' system, and beginning at P 1 speed to end at P 512, the asterisks also indicate a geometrical progression with 2, as above, as a common ratio.

In the third column (*p*), which gives the equivalents of both Wynne's and Watkins' speed symbols, the asterisks, again, denote the same progression pointed out in the preceding columns.

As to the figures between asterisks in all three columns, they represent the same geometrical progression as those marked with an asterisk, but all figures, in their natural order, and following each other, no longer constitute a progression. Thus taking, as an example, the first five figures in first column (*n*), namely,5.66, 7, 8, 10, and 11.31, it will be found that if we attribute to 5.66 a value of 1 the following relative values will be 1½ for 7, 2 for 8, 3 for 10, and 4 for 11.31.

TABLE B.

All figures in first column (*x*) are taken from Watkins' instrument in exactly the same order as they are marked upon it, and as no progressive symbols have been observed, we have had no occasion to proceed on this subject as we did in Table A. Wynne's equivalents (second column [*y*]), and H. and D.'s equivalents (third column (*z*), are, of course, exactly juxtaposed to figures in first column, and any worker using Watkins' meter can thus read at a glance the corresponding equivalents.

MODUS OPERANDI OF CONVERSION.

Wynne into Watkins.

Square Wynne and divide by 64.

Example: F 22·62 :—

$$\frac{22{\cdot}62 \times 22{\cdot}62}{64} = \frac{512}{64} = \text{P } 8.$$

Watkins into Wynne.

Multiply Watkins by 64 and take the square root.

Example: P 32 :—

$$\sqrt{32 \times 64} = \sqrt{2048} = \text{F}45{\cdot}25.$$

Wynne into H. & D.

Square Wynne and divide by 80.

Example: F 64 :—

$$\frac{64 \times 64}{80} = \frac{4096}{80} = \text{H. \& D. } 51{\cdot}20.$$

H. & D. into Wynne.

Multiply H. & D. by 80 and take the square root.

Example: H. & D. 102·40 :—

$$\sqrt{102{\cdot}40 \times 80} = \sqrt{8192} = \text{F } 90{\cdot}50,$$

H & D. into Watkins.

Multiply H. & D. by $1\frac{1}{4}$.

Example: H. & D. 25·60:—

$25{\cdot}60 \times 1\frac{1}{4} = \text{P } 32.$

Watkins into H. & D.

Multiply Watkins by 0·80.

Example: P 49:—

$49 \times 0{\cdot}80 = \text{H. \& D. } 39{\cdot}20.$

PHOTOGRAPHIC CHRISTMAS CARDS.

By J. Leisk.

There is nothing novel in the idea of a photographic Christmas card, for specially-designed mounts with appropriate mottoes are sold, on which photographs may be pasted; but to the true lover of the art who prefers to have the whole thing photographic, and his own work, there is ample scope for the exercise of originality in both taste and design in the method I am about to describe.

The idea is to surround a photographic portrait or view with an ornamental border bearing a suitable motto, both being printed on the same paper, so that the border frames the picture, which appears as if seen through it.

To proceed, make a draft board by arranging three or more rough boards together, and fasten by nailing other pieces across the back, and let the size be proportionate to the length and breadth of the plate you intend to use, 34 by 26 inches corresponds to the quarter-plate, and is sufficiently near to suit a half-plate also; on this board paste a sheet of cream or light grey wrapping paper.

The proportions being the same, it follows that any design placed on a board constructed as above will, when photographed, have the same relative proportions in the resulting negative that it has on the board, you therefore begin by outlining in pencil a suitable space in the centre of such form as your taste may dictate for the portrait group or view, leaving a sufficient margin outside on which to arrange the border. Next, having decided on the motto or Christmas wish, procure a number of small twigs of trees, currant bushes or the like, forked pieces, &c., all with the bark on. Cut these up and arrange them into rustic letters forming the desired words, and when complete proceed to attach them with glue to the border portion of the board, arranging the words in lines or curves according to taste, and put aside to dry.

The next step is to attach the border, the arrangement and design of which must be left to individual taste. It may be formed of sprays of creeping plants or any pretty leaves, with flowers, fruit, &c., attached by small tacks or black pins, care being taken not to cover the motto or to cross the outlined centre with the decorations, and as soon as finished it should be placed upright in a side light, the centre of the board being exactly on a level with the camera lens, and at such distance that the image of the board shall *almost* cover the ground glass focussing screen, sharply focussed, and two or three plates exposed to secure correct exposure.

Assuming that a satisfactory negative has been obtained, take a print from it on P.O.P. the size of the negative, and when printed sufficiently to show the pencil line round the central space remove it, and, with a sharp knife cut out the centre along this line, and expose both the mask and disc thus obtained to plain daylight to blacken as much as possible. Then paste the disc (blackened side up) over the back of the negative, and carefully adjust it in register over the part to which it corresponds.

Next having selected the negative which is to form the subject of the card, attach the mask in like manner to the back of it (dark side up), and so adjust it that the desired portion of the subject shows through the central opening. Both negatives are now placed in the printing frames, and a print taken from each, when one print will have a blank centre and the other a blank border, but these are now transposed, each to the other negative, care being taken by looking through them to see that the register is correct before closing the printing frame when a second exposure is made, which completes the printing of two copies, and so on. Having the two negatives, it takes no longer time to make two prints than it would printing from a single negative.

The object of placing the mask and disc on the backs of the negatives is to cause a slight vignetting through the thickness of the glass which causes the print and border to blend together, and prevents any slight error in the register being observed.

If our border design be arranged the vertical way of the board for portraits, and another the horizontal way for views, and a negative made from each, it follows that quite a number of subjects may be printed with the same borders, and when tired of one design fresh ones can be made with little trouble and at a nominal cost.

PROTECT YOUR LENSES.

By P. Everitt.

Few photographers have an adequate idea of the care taken in the manufacture of a first-class lens. There is scarcely an industry in which the standard of accuracy of workmanship is so high; yet a lens, when it passes into the hands of the photographer, frequently receives no more attention than any other portion of his outfit. After many years' use the surface of a lens, with ordinary care, should be in as good condition as when the instrument left the optician's hands; but how many do we see that are free from scratches, or other blemishes? The durability of a lens was forcibly impressed on my mind recently, upon seeing a working optician take up one, the surfaces of which were found in perfect condition, although the lens had been in use ten or twelve years. I have nothing new to say concerning the protection of lenses; but I hope that the repetition of a few hints may induce some photographers to give more attention to the most valuable portion of their apparatus. If the lenses are left attached to the camera, keep them capped when not in use. If taken for use out of doors, carry them in a substantial leather case. Clean your lenses periodically, and keep them in a dry place, where the temperature is even. To clean the lenses, unscrew them from the tube and carefully dust them with a camel-hair mop. Then moisten the corner of a perfectly clean old linen duster with methylated spirit, and, after wiping each surface, rub it quite dry and polish it with the other end of the duster, folded into a small pad. The chief thing to avoid is the rubbing of any dust or grit upon the surface of the lens, and thus scratching it. It is, therefore, recommended that each surface should be dusted with the brush, and that only well-washed, soft linen rag should be used for the polishing cloth. Dust the lenses again before returning them to the tube. They should be screwed well home, but not too tightly, or the lens may suffer. The whole process is very simple, and occupies but little time.

NOTE ON THE METHOD OF PHOTOGRAPHIC RESEARCH.

By **Philip E. B. Jourdain.**

The chief function of those who, more or less, devote themselves to considering the development of scientific research[*] is to point out the methods which involve the greatest economy of mental activity, so that the effort may be applied, as far as possible, where it is really required, and only there.

Owing to the practical application which gave photography its name[†], and which is, with some, its object, photography has been, and is, chiefly used by people whose tendency was, and is, to treat it unscientifically, i.e., to dispense with thought and use formulæ, while, if they "experiment," their method consists in trials of chance suggestions—no united thought, no working hypothesis (or as we should say, with Dr. Mach, no economic system of mental symbols).

It is, of course, ridiculous to suppose that any real scientific investigator needs such an obvious fact as the necessity of a guiding hypothesis for his experiments pointed out; I cannot, however, think that this is superfluous for some photographers. But more important (in the sense of having a wider range of usefulness) than this seems to be the fact that, as a general rule, those who have done the most important work in natural science have had their faculties specially trained in this sort of mental economy, which lies at the root of experimental research, by some science in which the role of speculation is specially emphasised, e.g., pure mathematics. Instances of this in photography are not far to seek; the two most prominent of the early developers of photography in England—Sir John Herschel and Fox Talbot—are examples.

The reason for this appears from psychological analysis.[‡] The mathematician and the inquirer into Nature, when indulging in speculative flights, employ quite analogous methods of procedure. The apparent difference in the methods is due, I think, to the difference, sanctioned only by tradition, in which researches in these two departments are described. The further discussion of this last point, however, does not concern photographers—it would be chiefly an enumeration of the sins of mathematicians.

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[*] Some would call this the "philosophy" of discovery.

[†] One might say that photography *is* the practical application; but one may also look upon the physical and chemical effects of radiation as a science, call *it* "photography," and regard picture-making as an application. This view seems justified historically in that a science of chemical effects of light began before picture-making. The impossibility of making a *separate* science of it I have spoken upon in The British Journal of Photography.

[‡] *Cf.* Mach; "Beiträge zur Analyse der Empfindungen" (1885), English trans, "Contributions to the Analysis of the Sensations" (Chicago, 1897), p. 179.

STAINED NEGATIVES.

By Alex Snaid.

There seems to be a great deal of difference of opinion amongst photographers as to whether a negative with a faint yellow stain is preferable to a clean black and white one. Some workers purposely aim at getting a yellow stain, while others are just as careful to avoid the slightest trace of colour in the film. There is a great deal to be said against a yellow-stained negative, but there are, it must be admitted, several advantages attached to it.

This yellow stain is one of the bugbears of the amateur who takes up photography more as a plaything than as a serious pursuit. He abhors the very name of pyrogallic acid. To him it means stained fingers, stained negatives, dirty dishes, and other evils. Consequently he has to content himself with hydroquinone, which, in a beginner's hands, often produces soot and whitewash results, and very rarely can you get such finely graduated negatives as are so easily obtained with the older and better, though dirtier, developer. Pyrogallic acid in the presence of an alkali, such as carbonate of soda, readily absorbs oxygen from the air or from the chemical substance with which it may happen to be in contact. It is this action which goes on in the developing dish, and the pyro, in taking up the oxygen, is itself decomposed, the resultant compounds giving to the solution that brown colour so characteristic of pyro. It can, therefore, be seen that, if this action should go on in the pores of the gelatine, the products will be deposited there in a finely divided state, thus giving to the film the brownish yellow tinge.

One great advantage accruing to the yellow stain is that, if the negative be a thin one, the stain is equal to intensification in a great many cases, and therefore you will get greater contrast. It may be a strange coincidence, but I have generally found that when I have got a thin negative the stain is either missing or is very slight. Be that as it may, if you can get the negative stained, either during development or afterwards by soaking in an old pyro developer, you will find it will be greatly improved.

If again, on the other hand, your stained negative gives a chalky result, it can very often be transformed into a soft and evenly-graduated one by removing the stain. There are various baths recommended for this, but, in the writer's experience, one of weak hydrochloric acid, say 1 in 20, will usually remove the colour, provided it is applied within a short time of development, and time is not allowed for the stain to set, as it were. You will then have a pure black and white negative.

To an inexperienced photographer this property of increasing contrast, which appears to be possessed by the yellow stain, is one of the points which throws him off the line when he changes his developer. When using hydroquinone or metol for the first time after being accustomed to pyro, he will find that his negatives are far below the requisite density, simply because he has developed to a stage which, when in conjunction with a yellow stain, would be sufficient, but which, in the case of a bluish-black deposit, is not by any means dense enough. A greenish or reddish-black deposit only allows a small proportion of non-actinic light to pass through, while a bluish-black one allows a certain proportion of actinic light to reach the paper covered by it. We have therefore got to aim for a greater amount of actual deposit when we have no yellow stain to help us.

There is one point to which attention ought to be drawn in connection with stains, and that is that it sometimes happens that the staining is uneven. If, for instance, part of the negative is not covered with developer and, while saturated with the solution, gets exposed to the air the decomposition of the pyro proceeds more quickly in this portion and a deeper stain results. In cases of this description the only procedure available is to remove the stain from the whole negative, and, if required, either intensify or stain again with an old developer.

There is no doubt that to a beginner it is far more difficult to judge the comparative density of two negatives when one or both of them may be stained, perhaps to different depths, than is the case if both are clean negatives, but this difficulty is removed by experience.

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BLANK SPACES.

By Edward Dunmore.

It is allowed that there are few more beautiful things in Nature than clouds. As I look from my window over a somewhat flat landscape I cannot but regret the opportunities neglected of securing records of such displays as I mark the infinite variety of forms with their ever-changing, ever-beautiful effects of light and shade and their unsurpassable gradations of tint, bold, strong outlines, pictures in themselves; but there is no need for me to indulge in rhapsody over displays there are few people cannot appreciate. Clouds have been written about times without number. I have indulged in diatribes on this subject myself more than once or twice, and yet for general work blank spaces are more general than well photographed skies. Only the other day I was examining a number of commercial views of Southend and neighbourhood, well mounted and got up, but in no single instance was the least vestige of cloud represented. A third of the picture was only blank paper. Most of them included a portion of the estuary, affording a capital opportunity for the introduction of clouds, yet all were blank. Thirty or more years ago before it was so easy to photograph clouds as it is at the present day, many attempts were made to modify the plain, blank whiteness of the sky portion; even if it was only a little shading down that was done. Now, with the rapid exposures, when moving figures are well and easily taken sharp and distinct, there should be no difficulty in having clouds as well, unless the times chosen for exposure are when there are no clouds about. If they were present the mystery is, how they could be altogether ignored and make no show whatever on the print unless special precautions were taken to shade off the sky in printing, and so render otherwise pretty subjects inartistic and commonplace. We have all experienced when out with our cameras beautiful sunny weather without clouds; this is no excuse for not having them in the print, as it is quite easy to add them afterwards, and even preferable in many cases, more artistic results being obtained. Photographers are supposed to educate the public taste in their own particular calling, but it seems doubtful that if commercial pictures—that is the general run of photographs exhibited for sale—not deficient in technique, are only made with the idea of curtailing trouble of production, sufficient only to produce a saleable article, the education resulting will be of a very questionable quality. I know very well rapidity of production and cheap labour have to be considered, but the having or not having clouds instead of blank spaces incurs so very little extra trouble, and then only in the first instance, that is the preparation of the negatives, that really it is no valid excuse. I have always felt that a landscape without clouds, providing the subject is a suitable one, is almost worthless as a picture. I would suggest, as I have on many previous occasions, that not only should time be spent in obtaining good cloud negatives, but that no landscape should be published without clouds, either taken with the subject or afterwards added. The improvement in the effect of the work would be patent to everybody with any artistic feeling. This welcome Annual is a medium for once again calling attention to what I consider a more or less neglected phase of photographic manipulation.

LANTERN SLIDES.

CONTACT *VERSUS* CAMERA EXPOSURES.

By Chapman Jones.

This subject is almost as old as the making of lantern slides, and has been settled one way or the other many times over. I think, however, that it is impossible to correctly state that either method is the better without defining the conditions and the desiderata far more exactly than is usual.

It is often stated that camera exposures give sharper definition than contact exposures, because the glass plates used are not flat. But this superiority, of course, depends upon the extent of the deviation from flatness, upon the method of giving the contact exposure, and upon other less important details, such as the lens used for the camera exposures, the skill of the worker, and so on. The amount of reduction, if any, and the method by which the result is to be examined, will also have to be taken into account. I do not ever remember to have been troubled by the want of flatness of plates when using magnesium ribbon with the plates at a distance of from three to six feet.

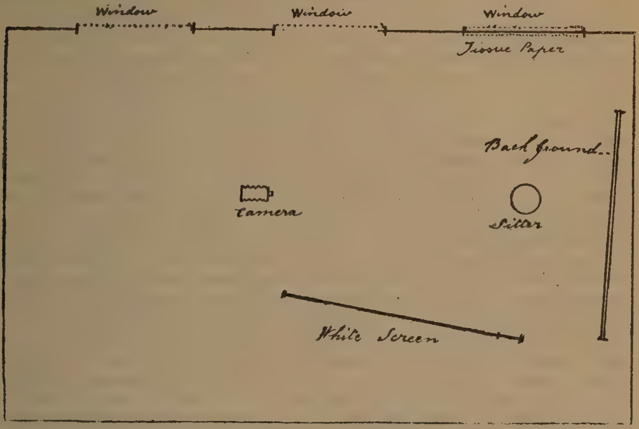
I have tried the same subject, some old houses, taking a whole-plate negative and making the slide in the camera, and also taking a small negative and making the slide by contact, and the resulting slides when shown on the sheet with the best of projection apparatus are so equal in technical merit that critical observers can find nothing to prefer in either.

But, if the slides are examined in the hand, then the one made by reduction is far preferable. The image is much more delicate, it appears less granular, and more full of detail. I have come to the conclusion that with equally good negatives and careful manipulation, if the slides are to be shown on the sheet only, then small negatives and contact exposures give quite as good results as the more expensive and tedious process of reduction. But for examination in other ways the reduction method is preferable. The great advantage of exposure in the camera is that slides may be made from negatives of any size, but this advantage disappears when the original negatives are taken for the express purpose of making the slides.

ROOM PORTRAITURE—SOME HINTS.

By Wilfred Emery.

Professional photographers are frequently called on to take portraits at their clients' own homes. As this branch of photography is now practically a part of their ordinary business, these remarks are not likely to prove of much service to them. There are, however, many others, outdoor or architectural photographers, amateurs, &c., who, for purposes of business or amusement, would occasionally like to take a portrait of a friend or so in the way of business, but do not do so because they have not a studio of the conventional type. Perhaps the results of my experience may be of some benefit to such a one. It is quite possible to take a well-lit portrait with a very short exposure in most rooms at a very little initial expenditure of time and money. The necessaries are a room with two or three windows on one side, a light background, some tissue paper, a large white screen, and a portrait lens. The following diagram will perhaps explain more clearly my arrangement:—



It is better to have the background on a frame and on castors, so as to easily place it at the best angle for lighting. Also the white screen, which should be at least 5 feet by 5 feet, had better be on castors. An old background can be whitened for this purpose, and answers admirably. The window at the side of the sitter should be covered with white tissue paper. This can readily be done with a dab or two of paste at corners and easily removed afterwards. With such an arrangement as this, a portrait can be taken in an ordinary room on rapid plates with a good portrait lens working at f-6 and the exposure ought not to exceed 1 sec. to 3 secs., according to the time of year. A few experiments will soon prove which is the best angle to place sitter, background, and white screen, and some very soft and beautiful lightings can be obtained. The other two windows need not be obscured with tissue paper, unless the aspect faces the sun. I hope these hints may prove of service to some who may have not yet tried room-portraiture, and I feel sure that success will reward them if they deserve it by trying again and yet again should their first efforts prove unsuccessful.

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THE BEST DEVELOPER.

By S. Herbert Fry.

One of the most difficult questions to answer in a satisfactory manner is, "Which is the best developer?" This is a question which presents itself as a vital one to the professional photographer, and a very important one to the non-professional. Perhaps the easiest way to approach the matter is to consider another question, viz., "Which is the best negative?" and the question may be completely answered by saying, "That one which best effects its purpose," for it has been already observed that the negative is but a means to an end. The opportunity of seeing a great many negatives leads me to think that some photographers do not regard the negative exactly as I do myself, as the principal tool (instrument) in producing the final photograph. Now, for a production of a number of similar articles, a tool should be self-acting or automatic, and to carry the metaphor to its conclusion, for the production of a number of photographic copies a negative is required which prints them automatically, that is to say, without faking or dodging, and in an even and regular manner. If such a negative be not produced, much valuable time if often lost in abusing the unfortunate printer, whose lot in life is made burdensome by being expected to produce regular prints from irregular negatives.

The first characteristic of a good negative, one which may be expected to effect its purpose, is that it shall be of such an appearance that its printing value may be estimated correctly by a visual test. In other words, it must be of such a colour or deposit that one can tell by looking at it what kind of print it will make. It is true that some operators pride themselves that their negatives print better than they look. A good negative should, I think, print as it looks. The only way to be reasonably sure of this characteristic is to make negatives free from colour and stain. Mr. Chapman Jones has described such a negative as consisting of a deposit of pure silver in clean gelatine; let us call it a deposit of silver, neutral black in colour, held in an unstained, uncoloured and unfogged gelatine film.

This is no new fangled idea, but an old practice. Collodion negatives were mostly of the black and white order; yellow and brown and yellow-green negatives were the result of early inexperience in the gelatino-bromide process, were due to the reluctance of the early dry plate to give sufficient density easily, were demanded by the necessity of printing from gelatine negatives on papers made for wet plate negatives.

The second characteristic of a good negative is that the deposit (the image) shall offer sufficient resistance to the passage of light to produce a good quality of print or other impression. Although I have called this the second characteristic, it is not of secondary importance, but only second in order of examination. The principal factor, with any developer, in securing this quality is a correct exposure correctly developed on a plate so coated as to be capable of giving a good deposit. This may seem either too comprehensive or too vague, according to the reader's fancy, but in effect it means that some plates will not give good resisting densities without the introduction of colour into the deposit, and that the secret of the quality of printing resistance, with plates that will give it, is correct exposure developed thoroughly out.

The third characteristic of a good negative is that the tone relations shall be reasonably true translations of the visual effect of the object represented. This effect is secured in the main by a successful combination of light incidence upon the object, and the use of a suitable plate, orthochromatic or otherwise; it is as much a matter of taste and selection as of photographic technique. Given the principal characteristic of a good negative, the choice of a developer is obviously the selection of that one which produces the desired qualities most regularly. I am disposed to think that some of the newer developers, say ortol or a mixture of metol and hydroquinone, do produce these regular results, and that they produce them more easily than our old friend, pyrogallic acid. This, I think, is the case for and against pyro—it has not been superseded by reagents giving better results, or requiring less exposure, or which keep better in a solution, but in short, as Mr. Micawber would have said, by developers which are more easy to work.

TIMING DEVELOPMENT.

By Alfred Watkins.

When I read a paper on developers at the Royal Photographic Society Mr. Ferguson inquired whether I had ascertained the variation in the multiplying factor caused by the addition to a pyro-soda developer of different amounts of bromide salts.

I replied that I had not attempted such a lengthy task. (Let me here interpose the explanation that in my plan of timing development, the time which the first bit of the image takes to appear is noted, and this is multiplied by a fixed number called the multiplying factor to get the total time for development.) I now find that the influence of bromide is ascertained much more easily than I then thought. I had overlooked Messrs. Hurter and Driffield's note (in their final paper) that the addition of bromide does not alter the development factor or steepness of gradation. In other words, if two similar negatives are developed for the same time in two developers alike in all respects save that one contains bromide and the other does not, the two negatives will have the same steepness of gradation in the correctly exposed parts. It follows, therefore, that the ratio between the times of the appearance of the two trials will give the inverse ratio between the multiplying factors. For example, I had been using a 2 grain pyro-soda developer without bromide, and found that a factor of 15 gave me a suitable contrast in gradation. I wanted to ascertain the factor for the same developer with ½ grain bromide added. In a trial, as indicated above, the "no bromide" appeared in 22 seconds, and the "with bromide" in 65 seconds. A rule of three sum gave me the required factor for the "with bromide" developer, thus:—

As 65 is to 22, so is 15 to – 5 (Answer).

It might be useful (to pass to another subject) if I here restate the method of timing development by a separate slip which I find so useful for panchromatic and spectrum plates. It obviates all difficulty about "safe" lights, as the plate is in complete darkness all the time. Some exposed slips are prepared beforehand by exposing a plate behind a grating in a printing frame to a standard light for four times the inertia of the plate. The plate is cut up into strips for future use. The grating is made by fastening narrow lantern slide binding (half-width) on a glass plate.

When developer is mixed a slip (held in a cycle-trousers clip) is dipped in it, and seconds counted. This is in the dark, but at intervals the gas is turned up for an instant to note the time of appearance on the slip. This multiplied by the multiplying factor gives the total time of development for the plate, which is then proceeded with in complete darkness.

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THE STUDIO CAMERA STAND.

By W. Thomas, F.R.P.S.

With the endless improvements daily made in material and apparatus, it seems more than strange professional portrait photographers remain content to struggle with the cumbersome affairs sold as stands to work their studio cameras upon.

Apart from loss of time and temper, may I add, when many changes in height and position of the camera have to be made, especially so when handling a difficult or fractious sitter, with a nice soothing temperature of 80° or 90°, there surely is nothing more funny than to watch a perspiring professional grind away for dear life at the handle which works the screws (which in their case raise or lower the camera) under such circumstances. There can be small need to request a sitter to show a pleasant front, and smile; for to appear, and feel other than amused, is surely difficult.

What one cannot help feeling is that some mechanical arrangement might be devised by a capable engineer to obviate all need for screw-propelling movements, and in place of it a simple up and down working of the camera, obtained by water-tubes or solid weights and pulley, the back and forward tilting being given by equally simple means.

That it can be done is certain, for I saw one such stand being used daily in a small portrait studio a short while ago, and on asking their assistant how it answered, he said it did capitally. All that was required to move it up and down was to take hold of the table on which the camera was fixed and push it down or lift it up as might be desired. On trying it I found it to work steadily, and with perfect ease, and one thing about it which seemed likely to be of considerable use with some class of sitter, babies, for instance, the camera could descend down to within one foot of the ground.

The stand was evidently a joint production of the photographer and local workman; and, in the absence of the former, I did not feel at liberty to too closely examine the details of construction, but it seemed so sensible a departure from the slow-moving affairs one sees in every studio as to raise the hope it might be put on the market when perfect, or that the owner and user of it might be induced to describe its construction and his experiences with it in every-day work for the benefit of his fellow professionals at present doomed to treadmill-like performances when the lens is wanted one or two inches higher or lower.

HINTS TO CAMERA, LENS, AND PLATE MAKERS: AN AMATEUR'S POINT OF VIEW.

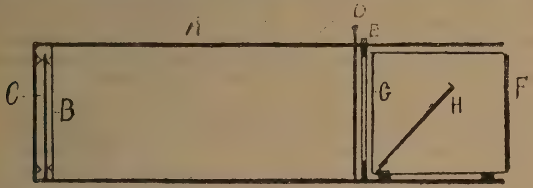
By Major C. Gardner Vatcher.

It has been a matter of great surprise to me that camera makers do not study the wants of amateurs more. Nowadays, when machinery is largely utilised in camera making, the finished article can be made very cheaply. If photography is to be more taken up by amateurs, and taken up as a permanency, the apparatus must not have defects calculated to discourage the pursuit of the hobby. It has been forcibly brought to my notice over and over again any time during the last ten years, and particularly when travelling abroad, how very defective some of the apparatus is. As an instance, the buildings abroad are as a rule, lofty, and the distance from which to take them limited. If only a greater amount of rising front were able to be used, or if only a wide angle lens could be used, some especial subject local photographers seem to have no difficulty about, could have been taken. My suggestions are as follows: That camera makers study the following points, even in the cheaper qualities. Of course, it is well understood that the best quality wood and finish would always fetch its price. I consider that in those popular sizes, the ¼- and ½-plate cameras, every square (Premier type) or conical (Kinnear) shape bellows there should be means to rack out to double the focal length of the plate, and with the same camera one ought to be able to use a wide angle lens of very short focus. The fronts should have more rise and fall than at present; the lens in the conical shape ought to be able to be raised at least as high for the top of it to be in a line with the top of the back frame in which the dark slide is fixed, and in the other shape within one inch of the top. The front in the conical shape should have means to swing it. The bellows, also, in this shape should be less conical than they are, especially in the ½-plate size, so as to enable one to go in for stereo work, if necessary. There should be also a double swing (with good range even when using a wide angle lens) and reversing back. The catches for catching the dark slides in the back frame should, by preference, be simple buttons; spring catches I have invariably found a nuisance owing to the springs being too stiff. In the conical shape the rising and falling front should do so with the bellows, to prevent any view being cut off, and the uprights supporting the rising front should be a little longer, and the front with lens able to be clamped at any height. An extra loose lens panel may also be provided with each camera. All cameras should be provided with turn-tables and steady stands of a threefold type with sliding legs. I am of the opinion that the back frames are far too clumsily made; there is no need for all that thickness or width of frame. This would permit of greater range of swing when the back is drawn forward for a wide angle lens to be used, especially if the base hinges are made longer to raise the back frame a little more off the baseboard. In hand cameras the mechanism should be of the simplest kind. I prefer the dark slide type, but good work is done with the "press the button" magazine type. I think bag changers possibly the simplest form and least likely to get out of order. If of the slide type, the camera should possess a good swing and reversing back, high rising front, and be able to be used with a wide angle lens. In all cases a clear view finder is a necessity, giving the view the right way on the glass. A camera maker has informed me my suggestions need not increase the cost even of the cheaper cameras. What a pity it is the ½-plate size is not the real one. 6½ by 4¼ is a much better size for symmetry, as well as more useful if going in for stereo work, then two ¼-plates (more likely to be got fresh than any other size) could be used side by side. It does not not affect the reversing back in the least. If possible, I should like to see that lens makers advertise that their three sorts of lenses still popular with the amateur—the R.R., the W.A.R., and the R. View—fit the same flanges. With these suggestions as a guide it may help a tyro in the choice of apparatus, and, in the words of a celebrated advertisement, "He won't be happy till he gets it." In conclusion, I think it would seem as if all sorts of obstacles are placed in the way of an amateur at present, and as a consequence lots have dropped photography in disgust owing to the defects they have discovered in the apparatus supplied them by dealers. I have no doubt that experienced men are able with very faulty apparatus to take some sort of a picture, but put good apparatus in their hands and see their results then.

MULTIPLE MIDGET PRINTS BY PINHOLE REDUCTION.

By G. F. Ashley.

One or more reduced sized prints on rapid bromide paper may be made at one time from an ordinary negative with the help of some simple apparatus. For a ½-plate negative size, a box (A) about 27 inches long, 7½ inches wide, and 9 inches high, will be wanted. It may be of cardboard or of wood, stained black. Fitted to the front end of this box should be a frame (B) for holding the negative (C). About 18 inches from the end should be fitted a light-tight shutter (D) to slide in grooves in the box, and intended to be drawn up for the exposure. Immediately behind the shutter will be wanted a slide (E), so arranged that it can be withdrawn from the box, and have inserted in it a thin black card of the thickness of a visiting card, but of sufficient dimensions to cover the bromide paper. In this card are made, by means of a fine needle, clean perforations not larger than 1-64 in. in diameter. If made finer or smaller a proportionately longer exposure will be required, but a correspondingly clearer result will be obtained. The perforations should be spaced according to the position and number of prints required on the sensitive paper. A second box (F) serves as a camera, and fits closely into the back end of the above-mentioned box. It should be made to slide backwards or forwards to regulate the size of the images. It should be provided at its front end with a square of ground glass (G). Immediately behind the ground glass should be a hinged flap or door (H), to be dropped when the images on the ground glass are to be viewed, and shut against the ground glass to exclude light when the sensitive paper is placed in the camera. The camera (F) may have attached to it an inch scale, with its divisions, for indicating the distance that the end of the camera protrudes from the box (A) when the size of the images has been determined, and consequently the distance between the pinholes and the sensitive paper. The sensitive paper is placed in position in the dark room in front of the ground glass (G), and is held by means of an elastic band at the top and another at the bottom.



The following table will convey some idea of the numbers and sizes of prints obtainable, with the normal exposure for the same, half-plate, size of bromide:—

Normal length of image.	Distance of bromide paper from pinholes.	Maximum number of pin-holes and images.	Arrangement.	Exposure.
in.				min.
$\frac{1}{2}$	$1\frac{9}{16}$	121	11 × 11	2
$\frac{3}{4}$	$2\frac{7}{16}$	49	7 × 7	5
1	$3\frac{5}{16}$	25	5 × 5	10
$1\frac{1}{2}$	$5\frac{10}{16}$	9	3 × 3	30

The exposure may be varied according to the actinic power of the light. For operating, the box should be placed close up against the window, and pointed towards the sky.

The bromide prints are developed in the ordinary way. Rapid smooth paper gives the best results.

* * *

LANTERN SLIDE IMPROVING.

By Osborn Thornbery.

There are not many slides made by the gelatine process which cannot be improved by either toning, intensifying, or reducing. It is surprising the difference it will make in a slide if it is toned to a colour to suit the subject. We tone our prints to a suitable colour. Why not our slides?

Transparencies that are of sufficient density, but muddy-looking in the shadows, can be made black and crisp if placed in an ordinary gold-sulphocyanide toning solution, as used for P.O.P. The toning may be complete in three minutes, but will sometimes take longer. The improvement can be watched by holding it up to the light. When the required tone is obtained, all that remains to be done is to wash the superfluous solution off and dry. The uranium bath is to be highly recommended, as it will suit nearly all subjects. The tones given by it are very warm, and vary from a sepia to a deep red, according to the time of immersion. The following is a very rapid toner:—

Uranium nitrate	4 grains.
Ferricyanide of potassium	4 grains.
Sulphocyanide of ammonium	20 grains.
Water	4 ounces.

Before placing the slide in the bath it is well to give it a thorough washing to remove all hypo salts, otherwise stains will appear which cannot be removed. It must be carefully watched while toning, and removed immediately the desired tint is reached. Then it should be well washed till all the greasiness is gone, and the water ceases to run in streaks. Do not soak in water or wash in a strong stream. Prolonged washing will remove the tone. It is useful to know this, because if by any means the slide becomes over-toned in this bath it may be easily reduced.

Moonlight effects can be obtained by slightly over-developing, and then leaving in the gold sulphocyanide bath till a blue tone is reached, or it may be placed in

Ferric chloride	30 grains.
Water	1 ounce.

for ten minutes, and then removed to the above uranium bath without washing.

A decidedly novel method of obtaining warm tones is by the boiling process. The formula for which is:—

Sodium hyposulphite	10 ounces.
Powdered alum	1 ounce.
Boiling water	70 ounces.

(This solution must be allowed to cool a little before use.)

The slide must first of all be hardened by placing in a cold solution of the above for ten minutes. It may then be put in an iron-enamelled saucepan, with the solution, over a gas-stove, and allowed to gently simmer. Toning will usually take from twenty minutes to a half-hour; after which it is advisable to give it a bath of alum and water (tepid) for about ten minutes, and then thoroughly wash in cold water for two hours.

A slide may often be improved by blocking out a portion of it—that is—painting over the part not required with opaque colours. For instance, full-length figures, if strongly lighted, have quite a statuary effect when the background is painted out, so that it appears perfectly black on the screen.

Numerous preparations have been recommended for this from time to time, but I find from experience that there is nothing better than ivory black oil colour, sold in tubes at about 3d. each. The "modus operandi" is to place the slide on a retouching easel, and mix the paint, by pressing a little out of the tube on to a piece of glass. To thin the paint add copal varnish, which will also help to dry it. Obtain a fine sable brush, dip slightly in the paint, and commence to lay it round the edge of the subject, taking care not to go over the outline, as the slightest dash will show very large on the screen. After the outline has been painted, fill in the rest of the background. Every spot must be covered over, or the light will filter through. I do not recommend water colours for the above operation, as the water causes the gelatine to swell when first applied, consequently the colour covers a larger area, and when drying it contracts and causes the paint to crack all over. Oil colours will not do this, as they have very little effect upon the gelatine.

There is nothing better for removing transparent spots in the shadows than by gently pencilling over them with a retouching lead. A needle with a very sharp point is useful for pricking out black spots in the high lights, but discretion must be exercised in its use.

It is not always possible to exactly judge the depth to develop lantern slides, and one is apt to get them too dense. They may be reduced to any density desired by using the following:—

No. I.

Saturated solution of ferridcyanide of potassium.

No. II.

Hyposulphite of soda, 2 ozs.; water, 10 ozs.

For use, take 2 drachms of No. I, and 2½ ounces of No. II. As soon as the slide has received the requisite amount of reduction it must be taken out at once, and well washed. If it reduces very slowly a little more of No. I may be added, but if very slight reduction is required, less of No. I must be used. When reducing a quantity of slides, No. I will have to be added when the bath works itself out. The ferridcyanide solution must be kept in the dark, as light causes it to deteriorate. By using one drachm of No. I and four ounces of No. II it will act as a clearing bath, and will improve all slides.

Sometimes we have a slide that no amount of developing will bring up to proper density without causing it to veil over. Now, this class of slide may easily be made presentable by intensification. This is done in a similar manner to negatives. For general use, I think there is nothing to beat the mercury-ammonia method. The slide is first of all well washed to remove any trace of hypo, and then put in a saturated solution of bichloride of mercury. The time of immersion will depend on the thinness of it. If very thin, it should be allowed to bleach right through. Well wash and place in

Ammonia	10 minims,
Water	10 ounces,

which will bring it back to its black colour. Thoroughly wash for two hours. The greatest care must be exercised in the manipulation of the mercury, as it is one of the most deadly poisons.

HOW TO USE GLASS PLATES IN YOUR ROLL-FILM CAMERA.

By Theodore Brown.

It may be of interest to some of the readers of this Almanac to know how this may be done. On the market to-day there are many cameras, the construction of which permits of glass plates being used, although they are really designed exclusively for the use of roll films. For example, take the No. 2 Bull's-eye Kodak 99 pattern, the core of which is roughly sketched in fig. 1. The maker's price for a roll of films to be used in this instrument is 2s. 6d., and as each roll is sufficient

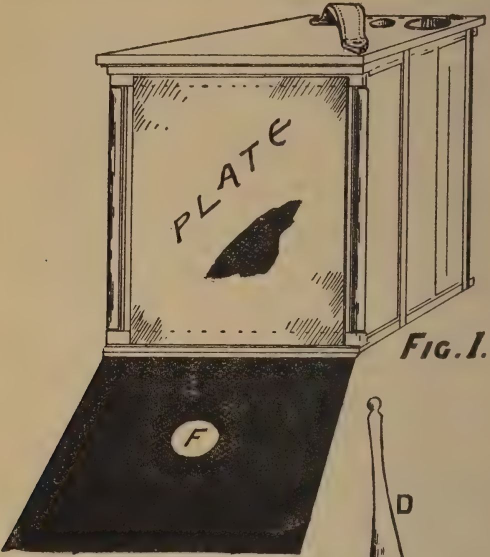


Fig. 1.

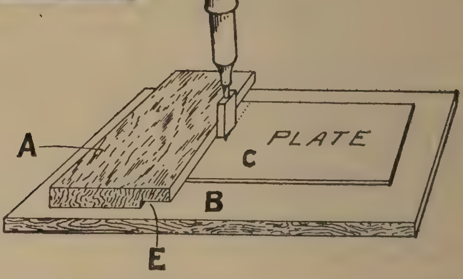


Fig. 2.

for twelve exposures, the film alone for each picture will cost 2½d. Apart from this fact, presumably the whole roll must be exposed before any particular picture may be developed. I am not quite certain that such is absolutely necessary; but, if not, it is, at least, the usual procedure. Under such circumstances it must be a source of annoyance to one who is anxious to know how he or she is succeeding, and whether any modification is necessary in future exposures.

Now, readers who own a camera of this particular pattern may use ordinary quarter-plates reduced to 3⅞ by 3¼ by cutting off ⅜ in. from one end. This is best done by using a gauge (fig. 2), consisting of a strip of hard wood A, fastened to a baseboard B. The upper surface of the baseboard should be covered with velvet or some other soft material, so that when the plates are placed on it, with the film downwards, they will not be injured by coming in contact with the woodwork. The strip is rebated at E, deep enough for the plate to drop in, so that, after allowing for the distance of the diamond point from the edge of its mount, ⅜ in. is cut off the end, leaving the plate 3⅞ by 3¼, a size which will conveniently fit into the back part of the camera, as shown in the diagram. The plate must, of course, be inserted under cover, or in a dark room. A piece of black paper or thin cardboard must be placed over the hole F (fig. 1), and the flap then folded against the back of the camera in the usual way. The whole is then placed in the camera, and all is ready for exposure. Although this method allows of only one exposure being made at one time, it is nevertheless a dodge which should prove useful to those who wish to reduce their expenditure in films, and at the same time take just as many photographs.

I have taken only one camera as an example of what may be done, and I leave to the judgment of those who possess cameras of similar construction, or of different size, to make cutting gauges according to their particular requirements, thus giving themselves opportunities of doing more work and gaining more experience at less expense than otherwise would be the case.

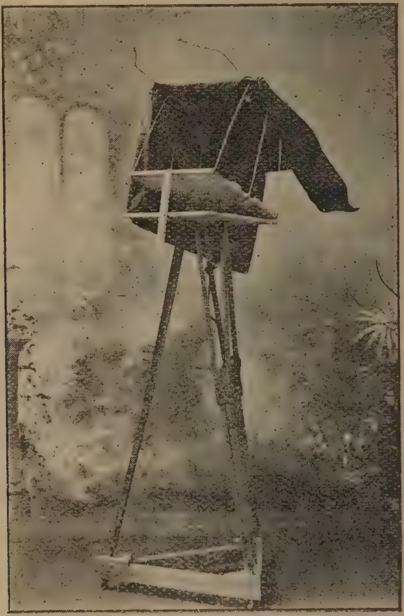
It should be mentioned that some cameras will take the usual size plates without cutting. For example, I might mention the No. 4 Bull's-Eye Kodak. In this case the 5 by 4 ordinary size plate may be inserted in the position usually occupied by the film, and as the back closes over the opening through which the number of exposures are observed, it will be found unnecessary to use a black piece of paper, as in the first instance.

A SIMPLE STUDIO CAMERA STAND.

By J. H. Wileman.

A description of a stand of the above nature will perhaps be of interest to some reader.

A glance at the accompanying illustration will show the general idea, and therefore I will content myself with giving the dimensions and other necessary details which sufficed for the stand I have now had in use some time. The foundation of the structure is a triangle made of wood, 2 in. by 2 in., each side of which is 24 inches long (outside measure). At each angle of the upper side is bored a hole of a size suitable for the insertion of the point of an ordinary sliding leg tripod. This should fit firmly, otherwise it may slip out when being used. On the underside of the triangle are screwed three castors, so that it can be moved easily on the studio floor. A tripod can now be fitted on the wooden triangle, and in order to get the fullest movement it should be one in which the leg consists of two parts, the lower of which slides right up to the tripod head. On to the tripod is then screwed a platform for camera made as follows: Two boards of equal size, viz., 16 in. by 12 in. are hinged together by the shorter sides (small drawing boards answer admirably). In the lower board is inserted a bush for tripod screw. On the top board, on which the camera is to rest, screw or tack a strip of wood along the front or hinged end of board. Place the camera on the board, press firmly against the front strip, and then screw or tack two small blocks of wood on each side of camera to hold it firm and prevent it slipping. In order to tilt the top board at an angle, get a strip of steel 9 in. long and 1 in. wide, and of a sufficient thickness to prevent any liability to bend, and in one end bore a hole for a screw, and underneath file sloping slots at intervals of half an inch the whole length of steel, and extending half the width of same. Screw the bar to the top board, allowing a fair amount of play, and in the lower



" GOOD NIGHT."—Graystone Bird.

Taken on a " Mawson " Plate.

Negative by His Grace the Duke of Newcastle, on a "Mawson" Plate.

board put a screw that will easily go into the slots cut in the bar, and then it will be possible to tilt the camera to any desired angle, and to hold it firmly there. The stand in the illustration is made for a whole-plate square camera. It will add a finish to the whole if a light wire framework be fastened over the camera and a fancy focussing cloth attached to same; this plan also prevents the hair getting untidy every time one has occasion to focus.

ALTER EJUSDEM.

By Procella.

Difficulty seems to be experienced by many in getting brown tones in their lantern plates. When printing these by contact, if they would only use Alpha plates or slow plates of a like kind, this difficulty would, to a large extent, disappear, as the colour can be modified both by exposure and development. The plates are so slow that over two minutes' exposure is required at a distance of from a foot to 18 inches from a gas flame. The exposure, however, can be made a matter of a few seconds, as the writer was the first to point out, many years ago, by burning about an inch of magnesium ribbon at the same distance. When the printing frame is placed in position the gas is turned up and the ribbon then ignited. The ribbon is sometimes slow in taking fire, but this can be overcome at once by dipping the end in either spirit or paraffin. One of the great difficulties with many beginners is in toning their prints. To all such, it would seem to be better where they use gelatino-chloride paper not to tone them at all. Just print a little deeper than usual, and fix in a very weak solution of hypo. When carefully washed and glazed on a ferro plate, they will have a nice brown tone, and look exceedingly well in the tyro's album. Many a beginner would find the pleasure he experiences in photography greatly simplified and increased by leaving out for a time the use of the toning bath, which is probably the only real difficulty a beginner has to meet.

It has been said by some one long ago that no one can be a skilful photographer until he has studied and practised the delicate operations of the collodion process. Thirty years ago, when the writer began photography, he considered it of great advantage to read the history of the art, and for this purpose he was allowed, by the courtesy of a friend, to peruse, perhaps in a cursory way, the whole of the volumes of The British Journal of Photography from its beginning, while under the editorship of Mr. George Shadbolt. This he considered a very great help to a right understanding of the methods then in use. If many of the beginners of the present time could only be induced to take a like course fewer questions about very simple matters would be asked in the photographic journals. As an instance of how little is done in that way, the writer would cite an experience of his own. The Club with which he is connected asked Mr. A. L. Henderson to supper. About thirty of the principal photographers in the town, both professional and amateur, were present. It fell to the writer to propose the toast of photographic literature. While doing this he quoted, much to the delight of those present, a few verses which appeared in The British Journal of Photography about the year 1857. Strange to say, none of those present had ever heard them before, except the late

Mr. Henderson, of Perth, who was present. These verses appeared first in a MS. Journal belonging to a private club in London, and, with the present Editor's permission, they may be reproduced here.

The Ballad of Billy Baker.

Tune, "The One-Horse Chay."

Master William Baker, the Carte de Wisit taker,
  Many young and pretty girls he'd wooed, I know;
But none had gained his heart until he took the Carte
  Of Miss Jemima Jenkins in his studio.

"Jemima, dear," said he, "my love's intense for thee,
  No other young and pretty girl has made me sensitive, I vow;
Your image is imprest on this excited breast,
  I'll develop, print, and fix it in my studio."

"Of silver I've nitrate, iron proto-sulphate.
  I've chloride of gold and lots of other rhino,
I've camera, lens, and stand, and all at your command,
  With heaps of apparatus in my studio."

The girl turned up her nose, "Take away such black paws as those,"
  With heart that's quite as black, for anything I know;
A negative I give, for I really couldn't live
  With a photographic duffer in a studio."

This to William Baker was a sad heart-breaker;
  "My head is out of focus everywhere I go,
My fate I'll soon decide, by taking cyanide,
  And do my final fixing in my studio."

To dark room then he went on suicide intent,
  But, instead of cyanide, he swallowed the hypo,
Which only gave him pain, and he soon got well again,
  And never flirted after in his studio.

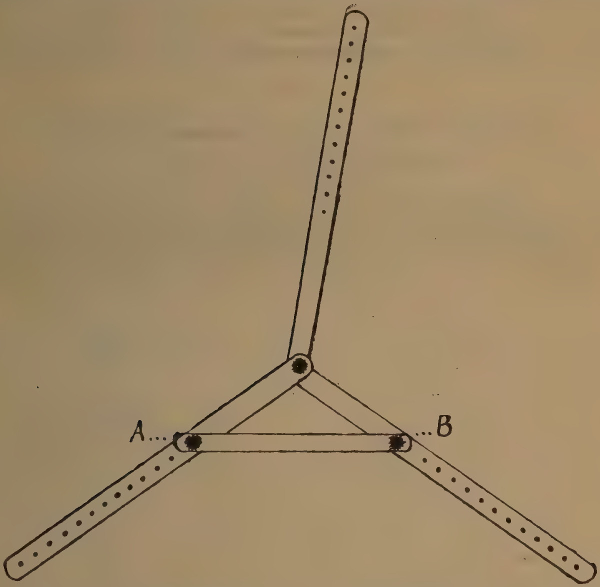
Moral.

Keep each proper label on bottles on the table,
Or when you want to kill yourself you'll not know how,
You'll only get the gripes among your precious tripes,
And feel very queer and funny in your studio.

PREVENTING THE TRIPOD FROM SLIPPING.

By Albert Levy (Asnières).

Last year I gave you the hint for a small contrivance which was intended to prevent tripods from slipping on floors, and although it was, I think, the best thing out at that time, I found it for general use rather heavy, as it is always to be used outdoors and has to be carried by hand. I therefore thought I could find something less heavy, and perhaps also less bulky, and here is an explanation of what I am using now with perfect satisfaction, the same being used by me for light as well as for heavy cameras with safety. I take three slips of wood about ⅛ to 3/16 inch thick, ½ inch wide, and about 24 to 30 inches long. I lay these flat one on top of the other, and bore a hole through all three of them within half an inch from end and insert through holes a thumb-screw, allowing to screw tight. Then beginning at twelve inches from that I bore holes through all three boards at regular distances from ½ to 1 in. apart to suit requirements up to the end. Now to use this, I open the three slips of wood and insert, after laying same flat on the



ground, one leg of tripod in each hole, as chosen for purpose wanted, regular or irregular. Above is a figure which shows the contrivance when opened.

This, however, is liable to move irregularly, as the legs when focussing or arranging the camera, may spread to right or left. To remedy this I have added another slip of wood between the two first holes, as in A and B, fastened with thumb-screws also, and this gives perfect rigidity all over. Now, when not in use the whole, which is of light but strong wood, folds up in a small compass of ½ inch thick on all sides and 30 inches long, and can be carried easily within the regular tripod.

HINTS FOR P.O.P. WORKERS.

By T. Stokoe.

Occasionally I have been troubled with markings on P.O.P. prints, which refused to tone even when the remainder of the print was bluer than I like to see it. I have recently found a remedy for this by mixing two or three drops of the gold solution (one grain in one drachm) with half a drachm of the toning bath in use, and applying this to the spot with the tip of a finger.

I have also found that the tone of the prints is better maintained in the fixing bath if that bath is made up with the nearly-spent toning. My plan is to keep a solution of hypo (1 in 2), thus avoiding the cold produced if the hypo is freshly dissolved, as well as effecting a saving of time, and to dilute for use with the toning bath from which prints have just been removed.

AN EASILY CONSTRUCTED DROP SHUTTER.

By Frederick Henry Varley.

Having a focal-plane and a see-saw shutter, I endeavoured to adapt them to a Dallmeyer ¼-plate R.R. Lens, but found no means ready to hand for the purpose. I then started upon the idea of constructing a shutter to fit on the hood of the lens which would answer my purpose

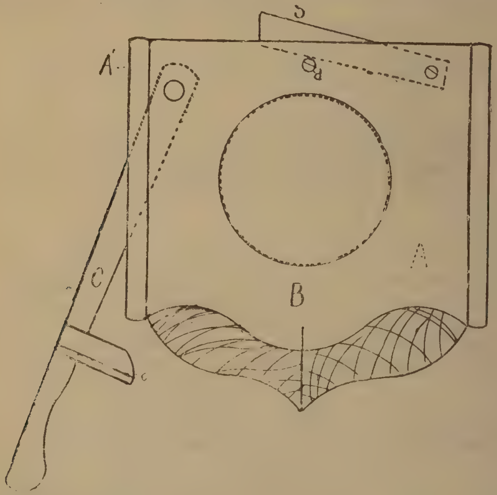


Fig. I

for obtaining a fairly short exposure. The device being very inexpensive as well as easy to make, I think it might interest some of the readers of the B.J.P.A. by describing it. Taking the wood of a cigar-box, I cut a piece 2½ in. by 2½ in., from the centre of this I drew with a pair of compasses a circle the diameter of hood. With a bradawl I made a circular ring of holes, and with a small saw, cut through from hole to hole until the central disc of wood was detached. The aperture thus formed in the square piece of wood I smoothed out and enlarged until it fitted the hood of the lens firmly. To strengthen the wood two narrow strips of cigar-box wood ⅜ in. broad were glued crossway of the grain at each end; next two side pieces were made ½ in. wide and 2½ in. long, then the shutter flap, and finally the trigger lever. Fig. 1 represents a front view, fig. 2 side view, in which A is the back, A' A' the side pieces, B the shutter flap, C the trigger lever, c clamping

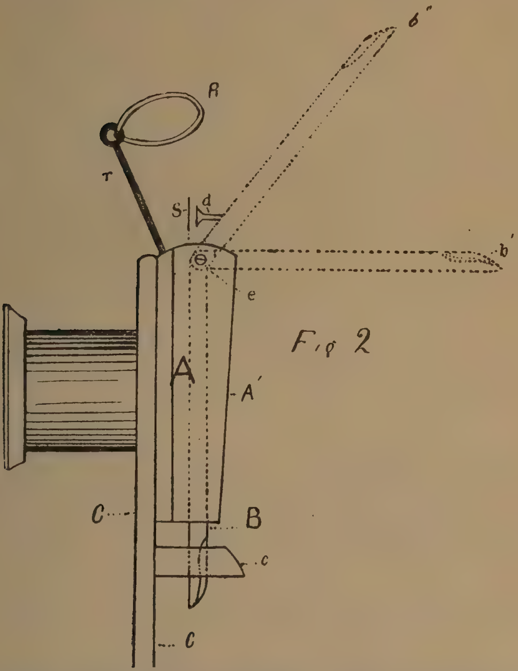


Fig 2

piece, S buffer spring, R an indiarubber band, T wire frame bracket support for the rubber band, d small woodscrew fastened to top of shutter flap which acts as a buffer stop, and also for the purpose of catching the rubber elastic band (R) when stretched (shown at fig. 3). The working of the shutter is very simple. The shutter flap B is clamped by pushing the lever C toward B, the lower end of which is chamfered, as shown in fig. 1, in order that the clamping piece *c* may pass on to it and hold the flap in the closed position. The rubber spring is then stretched and pulled over the screw d when the shutter is set ready for instantaneous exposure, which is made by pulling the lever C on one side. When the flap flies upward from B to b^{1} and b^{11} F2 the screw head strikes the recoil spring (S) after the rubber ring R has drawn itself clear off the screw head (*d*), the buffer spring reacting

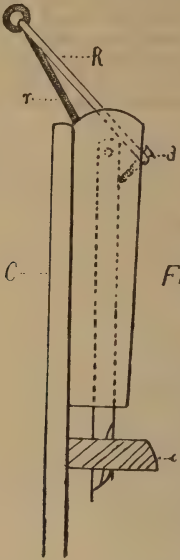


Fig 3

forces the shutter back again, causing it to close rapidly, when the lever C is again pushed toward B, and locks it. This shutter has the advantage of giving twice the amount of exposure to the foreground and middle distance as to the sky, and as the buffer spring yields to the impact of the shutterflap no appreciable jar or vibration is communicated to the lens or camera.

THE SNAP-SHOTTER.

By the Rev. J. Carter Browne, D.D.

With the thousand and one cameras that one sees in the course of an ordinary summer, and the peculiar questions to be found in several photographic journals, one can scarcely evade the feeling that a very large proportion of the exposures made either never see the light, or, if visible for a time, are soon put aside. The ordinary snap-shotter is generally to be seen mooning about in a desultory manner, with his Kodak, as it is generally called, depending from one hand—a furtive look about him as if he knew you were aware of his having a design to catch you in some particular attitude—and a general appearance of solitude, for they are seldom seen going about in pairs. He goes, we will say, to the sea for his annual holiday, hangs about the piers, watching the arrival of the steamboats, and occasionally looking down into the mirror on the top of his instrument. He knows nothing about the focus of his lens, which, except in high-class instruments is ordinarily worth little more than an old song—stops, he knows nothing of and cares less, and is as oblivious of the speed of his shutter as he is of that of his plates or films; and he goes to bed and gets up again next morning and fancies himself a photographer. As a rule he takes his annual fortnight or month between the middle of July and September, utterly regardless of the actinic power of the light he works in, and would be vastly surprised to be told that the actinism of the light on a very bright day in July or August is considerably less than that at the beginning of June, and that the difference between the time of exposure during the first week of March and Midsummer Day is as 10 to 1. At times he wishes to take the interior of a room, and although common sense dictates that it will require a longer exposure than usual, he would probably be surprised to learn that an interior must be very well lighted to require less than three hundred times as long as an outdoor view. In a church, as a rule, he plants his Kodak straight in front of a window, and to his dismay, if he gets any result at all, finds most of the moulding and mullions suffering from a very strong dose of halation. A snow scene—how exquisitely beautiful, with the millions upon millions of ice-spikes in weird confusion!—he must have it, but does not realise until too late that the light is just one-fourth as strong as it was during his August trip. And so on all round. I cannot follow him into the dark room or the printing phase of his hobby, but I do aver that if we could have schools of instruction in various centres, and that such would-be photographers would attend them, it would be a decided benefit to the cause, which we, all of us, more or less, have at heart.

KHAKI PHOTOGRAPHY.

A Plea for Its Preservation.

By Hector Maclean.

There is just now an opportunity which offers itself to photographers at large—more especially amateurs—which but seldom occurs. It is to preserve photographic records of that great war crisis which we are but just emerging from.

In after years such prints will be of quite unparalleled interest, and of immense service. It may be answered that in our days the illustrated periodicals publish so many photographs of the above character that everything notworthy may be found on the files of our weekly picture papers. This is, however, by no means the case. If the truth were known, probably not one photograph in a thousand of those which possess a greater or less amount of historic interest has been at the service of editors.

The writer has a good many opportunities of knowing what editors of illustrated papers get sent to them, and also what a large number of interesting and striking prints never leave the amateurs' possession.

Thus, some of the best snap-shots of the Bluejackets marching through London were taken by an acquaintance, and have not been seen by a dozen people. A score of similar instances might be cited. It is, however, less for such occasions that I make this appeal; but throughout the breadth and length of the land there have been an extraordinary number of curious, striking, and generally interesting occurrences which more especially in the smaller towns, and less populous districts, those who come hereafter will find of considerable value as pictorial documents. The business of making collections of local photographic records, such as are referred to, is unfortunately anybody's, which means nobody's, affair—hence these lines.

I would earnestly suggest that some one in each district, preferably the Secretary or other influential member of a photographic or other Society, or an official connected with a Free Library, or other similar institution, should make known to all amateur photographers in his vicinity—

1. That it is desirable to collect and preserve for future reference photographs of interest regarding scenes and events connected with the South African war and the popular and military occurrences which transpired.
2. That all such prints contributed may be either of local subject, or taken outside the immediate neighbourhood by the contributor.
3. That each print should preferably be printed in carbon or platinotype, bromide paper being the next most suitable. But other printing processes be permitted, although discouraged.
4. That each print be accompanied by title and date; and whenever called for, should have a few lines descriptive of the subjects pictured; specially should the names of prominently-known persons be mentioned.
5. The person collecting the prints should engage to arrange, tabulate, and mount all prints, and eventually deposit the collection with the most suitable local institution or society.

SOUTH QUEENSFERRY AND VICINITY.

By J. A. Reid.

A walk across the Forth Bridge, which is certainly one of the wonders of the nineteenth century and a triumph of British engineering skill, is a pleasurable and impressive experience. Here, at a height of some 400 feet from the waters of the Forth below, the panoramic scenes presented are full of charm. Magnificent views are obtained of the Firth of Forth, of the Ochils, the Pentlands, and of the Grampians. The whole district in the vicinity is a very beautiful one. Near at hand are the Scotch homes of two prominent noblemen—Lord Rosebery and the Earl of Hopetoun, the Governor of the newly-constituted Commonwealth of Australia. In the Firth below, one of H.M.'s training ships may be always seen; and but a few miles away lies "Modern Athens," the beautiful city of Edinburgh. The photographer, therefore, has any amount of material at hand.

The charming grounds of Dalmeny, Lord Rosebery's seat, fringe the

Firth of Forth, at the foot of the bridge. The residence itself is some two miles away, but on the shore is Barnbougle Castle, formerly a picturesque relic of the fifteenth century, but restored in 1880, and now used as a supplementary residence. There is a quaint legend in connection with Barnbougle to the following effect: It was said that when the death of any of its lords was about to take place, a man, clad in black, accompanied by a hound, appeared on the promontory close by, to sound the death-note of the Baron. Hence the name Barnbougle.

A striking feature of the coast here is the enormous quantity of cockle sheels which abound. In the words of the humble poet, Tom Orrock:

> Dalmeny, bonnie hills and dells,
> White sandy shore an' cockle shells,
> The primrose sweet an' Scotch blue bells,
> Are bonnie aye tae view.

There are many beautiful walks in the locality, and several places well worth visiting. South Queensferry at the foot of the Forth Bridge is a quaint townlet. It owes its name to the fact that it was at this point where Queen Margaret, wife of Malcolm Ceannmor, frequently crossed the Firth. The restored remains of an old Carmelite Priory, erected in the fourteenth century, are now used as an Episcopal Church. Close to the pier is the Hawes Inn, referred to in "The Antiquary" and Robert Louis Stevenson's "Kidnapped."

The church at Dalmeny is considered to be one of the most perfect specimens of Norman architecture in Scotland. Dundas Castle, with its old keep, from which invigorating breezes and grand views are obtainable, is in the immediate vicinity; and at the little village of Kirkliston the twelfth century church (restored in 1884) is worth inspecting. The Lady Ashton of the "Bride of Lammermoor" is buried here.

The beautiful grounds of Hopetoun are open on Wednesday and Saturdays.

Linlithgow, with its old Church and Palace ruins, on the one hand, and Edinburgh on the other, are within easy cycling distance. And of Edinburgh, it need not be said, the photographic possibilities are almost inexhaustible.

Applications to walk over the Forth Bridge must be made either to the resident engineer or to the general manager of the line.

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PHOTOGRAPHING MACHINERY.

By J. H. Smith.

Being called upon to photograph some machinery in a large cloth mill, and not having undertaken this class of work before, perhaps a few remarks as to the results attained may be useful to at least some of the younger members of the profession. In the first place I used Electric plates backed to prevent halation. In one department I had to make an exposure of 10 minutes, and the second plate 15 minutes. In this case the machinery could not be stopped, and the workmen were going about their ordinary work, but as they did not stand still for more than a few seconds and were walking about all the time, there was no blurring perceptible in the resulting negative, which was fully exposed. In another department—the loom sheds—I gave an exposure of three minutes on an Electric plate, stopping the lens down (which was, of course, wide angle) to *f*-22. In this room there was a very good light. The machinery was stopped for the time stated, but driving gear and belting were running, but this did not cause any blur in the negative on development. In another department—the mending room—which was situated at the top of the building over the principal machinery, the vibration was very great, and as the machinery could not be stopped I had to make my exposures at the time, fully expecting that the negatives, on development, would be useless, and was very much surprised to find the negatives when developed were in every respect perfect, showing no movement on account of, I suppose, the vibration being general. These few practical remarks may perhaps be useful to some brother professional who, like myself, goes for the first time to photograph machinery of the same description as mentioned in this short contribution to the ALMANAC.

AN ELEMENTARY STUDY OF SIXTEEN.

By J. DORMER.

WHEN one remembers the persistence with which the alchemists sought the philosopher's stone, it is awful to observe their bland disregard of the pecuniary difficulties its discovery would involve mankind in. It would be a sufficiently unhappy time for creditors when lead is transmutable into gold, but imagine a State forced by circumstances to adopt polymetallism! It would break the heart of any Chancellor of the Exchequer. Possibly on account of the dim recognition of these dire consequences, hunting the philosopher's stone has fallen into disrepute, and is mentally associated with empiricism. It is still, however, permissible to hypothecate the derivation of all the elements from a common stock. The terminology is modernised. The Alcahest of Paracelsus has developed into the Protyle of recent times.

An arrangement of the elements at present known in well-defined groups and series is rendered possible by the simple numeration of their atomic weights in numerical order. But the plan of delineating such groups and series on a plane surface seems inadequate to demonstrate some relationships which seem to exist. Perhaps if the stereography of Mendelejeff's table were exchanged for some arrangement of the atomic weights in a solid geometrical figure, it would be advantageous. A two-dimensional sketch of a three-dimensional universe is sufficiently satisfactory, but a model might be better. Required, then, a crystallisation of the table in which the periodic functions of the atomic weights are exhibited by their positions. Is there scope for the ability of a Kekule or a van't Hoff in this direction?

On the hypothesis that variation in the properties of molecules accompanies variation in the configuration of their constituent atoms, many phenomena of allotropy and polymerism are explicable. The idea of a fundamental protyle from which the other elements have been evolved needs some numerical relationship to be established between the atomic weights of the elements before associating periodic function with variation of the number of protylic atoms in the elementary molecules. By way of example one may take 16, a suggestively divisible number, which is the atomic weight of oxygen. It has a noticeable connection with many atomic weights. Those of molybdenum (96), bismuth (208), terbium (160), and uranium (240), being exact multiples of it; and, taking the weights of another eight, viz., sulphur (32.065), titanium (48.17), copper (63.6), bromine (79.955), cadmium (112.3), tellurium (127.5), neodymium (143.6), and iridium (193), one finds that on the average they differ from some multiple of 16 by only .355.

Again, over thirty "pairs" of atomic weights can be bracketed, the difference between the two components of each of which is either exactly or approximately 16, e.g., calcium (40) and iron (56), cobalt (59) and arsenic (75), osmium (190.8) and lead (206.92). In thirty-three cases there are eight "pairs" with the difference exactly 16, thirteen with a difference less than 16, and fourteen with a difference of more than 16 (no "pair" being admitted whose difference exceeds 16 by 1, or is less than that number by the same amount). The minus differences average a trifle over .5, and the plus differences .21, giving an average difference of atomic weight between 27 "pairs" of 16 plus-minus .35, or between the 33 "pairs" of 16 plus-minus .29. A difference of 15 exists in three other "pairs," and of 17 in four more. In addition, there are seven "pairs" (each with one component not included above) whose differences average 32 plus-minus .49, and two more whose differences are exactly 32.

Here, then, are the atomic weights of over sixty elements closely related to the number 16. It would be remarkable if such a connection were fortuitous, but no arrangement on a plane surface seems capable of bringing the 16-relationship into harmony with the periodic functions. Hence one speculates whether any crystalline structure would meet both requirements.

DOCTORING AND PREPARING NEGATIVES FOR PRINTING.

By P. J. Slater.

However much care be taken in exposure, development, and the various other manipulations connected with the making of negatives, it often happens that the finished negative is far from perfect. When such is the case, it is advisable, whenever the conditions allow of its being done, to expose a fresh plate on the subject. It often happens, however, that it is not possible to do this, therefore recourse must be made to some means whereby the existing negative may be improved.

A common defect in many amateurs' negatives is lack of density and detail, caused either through under-development or under-exposure. The hand camera, although a most useful instrument in the hands of an advanced worker, and when used under suitable conditions, is the cause of many thin under-exposed negatives. Beginners starting with such a camera often overlook the conditions under which their exposures are being made, and when shutters are being worked almost at lightning speeds, and small stops inserted, "to give a sharp negativè, you know." only one result can be arrived at, viz., under-exposure. Under-exposed negatives, as every one knows, consist of dense patches representing the high lights, while the shadows are often represented by almost transparent glass. Such negatives cannot be satisfactorily doctored by chemical treatment pure and simple, intensification alone merely piling up the density of the high lights, without bringing out more detail in the shadows. The following method of improvement may be employed with advantage in many instances. The high lights are first of all reduced slightly by means of a solution of ammonium persulphate, which should be used rather weaker than is usually recommended. Two drachms of persulphate to ten ounces of water will be found plenty strong enough for the purpose. As soon as slight reduction has taken place, the negative is placed at once in a ten per cent. solution of sodium-sulphite to arrest all further action of the persulphate. The negative is then well washed and dried.

Cut a piece of fine white tissue paper, or, what is preferable, papier mineral, the size of the negative, damp it, and then stick it on to the glass side of the negative. Allow it to get thoroughly dry, and then, with the negative supported in a retouching easel, carefully go round the dense patches with the sharp point of a pen-knife, and then scrape away the paper from these portions. This operation will reduce the contrast in the negative considerably, and keep back the shadows, while allowing the denser portions to print. If necessary, the paper covering the shadow portions may be worked upon by means of a stump and chalk, or a soft black lead pencil.

If preferred, matt varnish may be employed in place of the tissue paper, or, if working up is not necessary, a yellow dye, such as Judson's, may be applied to the back of the negative, and scraped away where desired. Intensification should not be resorted to unless the negative is a suitable one for the purpose. Thin, over-exposed negatives, or negatives which have not been developed far enough, but with abundance of detail and clear shadows, are the most suitable. It is absolutely necessary that the negative should be thoroughly freed from every trace of hypo before being placed in the mercuric solution, and it is also advisable to use distilled or soft water to wash the negative both before and after immersion in this solution. If proper attention is not paid to this, stains will inevitably result.

For blackening the bleached image a solution of sodium-sulphite is preferable in many ways to ammonia, as the image produced by its action, although not so dense, is much more permanent than that produced by ammonia. It may be used in the proportion of two ounces of sulphite of soda to ten ounces of water. If after this treatment the negative has not attained sufficient density, the operation of intensification may be repeated as often as necessary.

If a negative is fogged and thin through extreme over-exposure, the fog should be removed first by the aid of a reducer before any attempt is made to intensify it. I find that the best reducer for the purpose is Farmer's ferricyanide and hypo. The formula for this reducer will probably be known to all readers of this paper, therefore I need not repeat it here. When the fog has been cleared the negative is well washed before being placed in the intensifying solution. If any doubt exists as to whether the hypo has been thoroughly removed or not, it is a good plan to soak the negative for a few minutes in a fairly strong solution of common salt, well washing again before immersing in the mercury. It is by no means a rare occurrence with landscape negatives for the sky portion to be thin, which prints out one even tint, and makes the sky portion of the prints too dark for the after-printing of clouds. When this is the case it is advisable to block it entirely out. This I do as follows: With a fine camel's-hair pencil, charged with vermilion water colour or "Photopake," the portion of the sky adjoining the landscape is gone round carefully, making a line from about one-eighth to one-quarter of an inch in depth on the film side of the negative. The rest of the sky is then rendered opaque by pasting on to the glass side a piece of non-actinic paper, cut to shape, so that it will just overlap the pigment applied to the other side. This is a better plan than doing the whole of the work upon the film side of negative.

Negatives of interiors often require considerable working up before a good and harmonious print can be obtained from them. Coating the back with papier mineral as recommended for under-exposed negatives, and judiciously cutting it away from places where it is desired to emphasise detail, and colouring other places with stump and chalk, it is desired to lighten and improve such negatives in a wonderful manner; in fact, some of the finest architectural work seen at the leading photographic exhibitions has been treated in this manner. When unbacked plates are being used for interiors, halation is almost sure to show itself. It may be locally reduced by rubbing the parts of the negative with a piece of chamois leather, stretched over the end of a pen-holder, and just moistened with alcohol. Care must be taken, however, not to apply too strong a pressure, or the film itself may be injured.

Pinholes and transparent spots caused by air bubbles in the developer should be spotted out by means of a fine camel's-hair brush and water colour or Indian ink. The colour is best applied almost dry, as too much water causes the gelatine to swell and repel the colour. The parts covered should be made, if anything, rather darker than the surrounding portion of the negative. If a light patch is produced on the print it may readily be spotted out after the print is mounted.

It sometimes happens that a negative gets cracked, the film remaining intact. When such is the case a clear piece of glass the size of the negative is placed in contact with the glass side of the negative, and the two carefully bound together with lantern slide binding strips. Printing should be conducted by placing the frame containing the negative in the bottom of a deep lidless box, keeping the box revolving the whole of the time by suspending it with cords attached to the sides. This is a much better plan than attempting to strip the film from the glass, and I have made many prints by this method, and no trace of crack is visible on them.

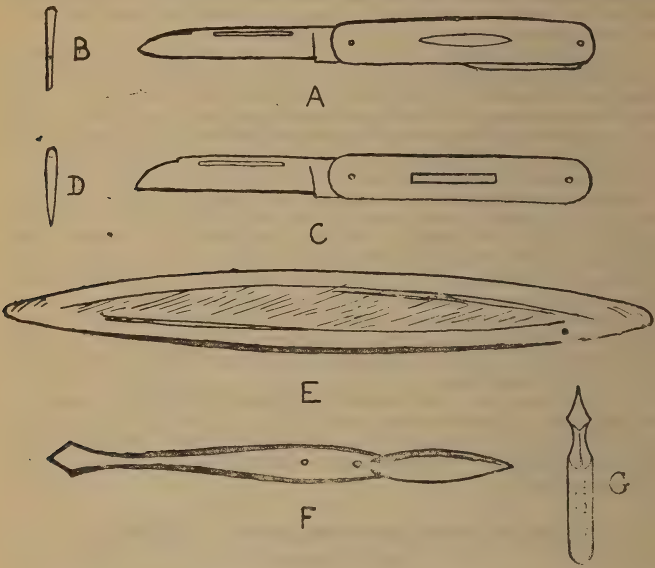
The foregoing are a few methods of improving defective negatives. Do not, however, judge of the quality of a negative by its appearance alone, but test it by taking a print from it before attempting any method of dodging. The prettiest negative does not always produce the finest print.

KNIVES FOR PHOTOGRAPHIC PURPOSES.

By A. Lockett.

The photographer is often requiring sharp and reliable knives for cutting prints, and for other purposes, and is sometimes caused much trouble and inconvenience by unsuitable and impracticable implements of this description. Perhaps a few hints on the qualities to be sought for in them, their different uses, and the best means of keeping them in good working order, may find favour with some.

Firstly, and most indispensable, comes the knife used for trimming prints. With all apologies to wheel trimmers, cutting machines with guillotine-like blades, and other ingenious devices, it is perhaps not too much to say that the majority of us wisely adhere to the humbler but more trustworthy penknife. For the performance of satisfactory work it should possess the following qualities:—Rigidity and thinness of blade, flat on one side; moderate length, and keen, straight edge, gently curving towards the point. The illustration A will give a good idea of the most desirable shape; while C represents a common, yet incorrect and objectionable form, inasmuch as the decided and abrupt point is liable to tear the prints; the severe straightness of edge, too, does not lend itself to sufficiently easy handling. The gently curved point of A not only helps to avoid any sudden break in the cut at the finish, but enables the knife to be conveniently raised as it is drawn towards the body, thus securing ease of movement. As shown in the section B, the ideal blade should be perfectly flat on one side, thus enabling it to cut close to the glass shape, and keeping the knife square and straight. It should be said that the knife described is not suitable for cutting all round the print in the usual way; it will be necessary to turn the latter after cutting top and right-hand sides—a plan which gives better results, if it is not quite so quick. The disadvantage of a blade of section D, with both sides more or less curving, is the pos-



sibility of its shifting position relative to the glass during cutting, so that the resulting cut is not truly straight. Unless such a knife is kept at exactly the same angle throughout the cut—a difficult matter—it is easy to see how this may happen. Knives for cutting prints are best sharpened on an ordinary oilstone, without oil; one of the shape shown at E is perhaps the most suitable. The stone should be fine and hard, or using it without oil will soon wear it away.

The knife handle is of more importance than might be supposed, for a comfortable, steady grip, largely depends on its suitability in shape and material. This, of course, must be left to common-sense and individual fancy, it being simply suggested that a fairly large one is best, and that it should, if possible, balance the weight of the blade. It should not be too smooth lest it slip, nor the reverse, or it will not conduce to comfort.

Another knife valued by the photographer is that wherewith he is wont to scratch away on his negatives, removing surplus cheek and waist, intrusive black spots, and the like. Perhaps the very best thing of the kind is a small surgeon's scalpel of the shape shown at F—the smaller the better. This may be kept keen-edged on a small flat oilstone, specially reserved for it, and used with oil; if treated with care it will not often require sharpening. This handy little tool is also serviceable for removing spots from bromides, platinotypes, and carbons, and for many other delicate purposes.

A useful cutting nib is now obtainable (G), which is valuable for trimming circular pictures, and for scratching out on negatives, prints, &c. They may be sharpened in the same manner as the scalpel. The nibs as recommended, may be inserted in an ordinary penholder. They are of excellent steel, but very often are not sharp when sold; this, however, is quite immaterial, and is easily remedied.

SNAP-SHOOTING.

By Hussar.

Nearly everybody rejoices in a hand camera of some sort nowadays, and fills the family dustbin with the inevitable failures, and if one did not feel sure that the photographic fiend was only wasting his plates when he was taking a snap-shot at you from the pier-head as sick and weary you climb up the steps from the mail steamer, you would go for that fiend and damage the cheap camera in which his soul delights. Fortunately, it is only a few who misuse the art and make themselves so objectionable. I have for many years, in India and elsewhere, used the hand camera in taking views and groups in city and village life, so perhaps if I jot down a few hints, they may prove useful to those who are just entering the thorny paths of photography.

In taking moving groups and individuals, I was advised by a professional photographer, whom I consulted many years ago as to the best way of taking instantaneous pictures, always to take them from a platform or position from ten to fifteen feet above the ground. This has the effect of cutting off the unnecessary part of the foreground, and bringing the nearest group within sufficient distance to ensure sharpness of focus. Nothing looks so bad in a photo as for there to be a figure moving across the picture out of focus, and yet it is a common fault to be seen in many snap-shots published in the illustrated papers. In photography in the East, when going through a bazaar, I used to take my snap-shots from a high dog-cart. This I found a very good plan, as independently of preventing any crowding in on me, I was able to pick out any group or person I desired. Sometimes I made my servant set up my large-sized camera, and having thrown open the ground glass screen, let the natives standing near satisfy their curiosity by looking inside. In this way I obtained many interesting types of faces. Another very important matter (I repeat again I am only writing for beginners) is to be careful to keep your camera steady, or a sharp picture cannot be obtained. To do this press the butt end of the box against your chest, and hold your breath as you let go the shutter.

Very rapid plates for most subjects are a mistake from the loading your camera to the developing them. Amateurs' dark rooms, as a rule, are lighted with a very unsafe light, and the result is fog. Don't expose your plates instantaneously on very darkly-lighted subjects as under trees and interiors, and then force the development. The result is most unsatisfactory.

The following developer will be found the best, I think, for most plates. I always use it, and have every reason to be satisfied with it:—

Sulphite of soda	100 grains.
Water	2 ounces.
Amidol	10 grains.

Add 15 minims per ounce of a ten per cent. solution of citric acid. Quite enough density with this formula can easily be obtained.

HAND CAMERA WORK.

By R. A. Hamblin.

There is a great and increasing tendency at the present time, even amongst experienced photographers, to take up with the light and easily-manipulated hand camera, and cast aside its heavy and unwieldy relative. Who, that has groaned under a whole-plate kit for fifteen or twenty miles of hilly country, does not view with covetous eyes the dainty little instrument, the weight of which he would hardly feel, and which would enable him to produce small pictures, it is true, but still pictures which, should they please him, he can enlarge and treat as his artistic instincts direct?

Fears have been expressed in various quarters that this hand camera movement will do photography no good, and will only result in an all-round deterioration of the standards of photographic excellence. Indeed, some critics profess to have seen signs of this falling off on the walls of our exhibitions last autumn.

Whether these signs exist or not, and I am inclined to the latter view, the fact remains that pictures which evidently showed their origin in the hand camera received a good deal of attention at the hands of the hangers, and in some cases even took the highest awards.

Certainly the hand camera has opened up fresh fields of labour for the ambitious worker. To me, the chief object of its use seems to be the recording of the more fleeting sides of nature and life. To these, the construction of the instrument is peculiarly adapted. As an example, might be instanced the many quaint, old customs and usages with which our country districts still abound, although they are fast dying out before the advent of machinery and factories. Much good work of this sort has already been done by country clergymen, among whom are to be found a large percentage of camera-wielders. They, of course, have splendid facilities for work of this kind.

Those workers who are compelled by a fate, cruel or otherwise, according to their individual tastes, to confine their attention to the town, will find plenty of subjects among the swarm of industries that surround them. They will always find in these days of rapid changes and innovations some that are on the decline, some that will be extinct ere many years have passed away.

Street scenes lend themselves admirably to pictorial effect, particularly after a shower, when the pavements are broken up by shadows and reflections, and a slight mist hides the more obtrusive details. The serious worker, if he keeps his eyes open, will find in the streets numbers of real "gems" in the way of "genre" pictures and figure studies, often humorous, more often pathetic. It has been said, and with some degree of truth, that no photographer has a right to break into the privacy of such scenes as these. But I think it all depends on the spirit of the worker. The snap-shot fiend who attempts to ridicule and find something ludicrous in the most solemn of situations, even at the expense of his victims' feelings, ought to be hounded off the face of the earth, and he certainly richly deserves his fate when, as sometimes happens, an irate victim smashes his camera and destroys the beauty of his countenance as some slight recognition of his services. In attempting such scenes every care should, of course, be taken to keep the instrument concealed from view, or, at any rate, unobtrusive.

The photography of animals, especially domestic animals, is well suited to hand camera workers. Kittens and puppies, for instance, lend themselves to endless varieties of pictures, and with a little patience many really humorous studies of these creatures can be produced. Regarding children from the bachelor's point of view as young animals, I may remark that they make delightful subjects for the camera, especially when young enough to be ignorant of that instrument's functions. Who has not noticed the difference in the expression of their little faces as they march solemnly off to school and as they come rushing out bubbling over with joy to find themselves free creatures once more?

To enumerate all the fields open to the hand camera worker would take up far more space than this little article is intended to occupy. The one or two I have given will immediately suggest many others to the reader's mind.

Many beginners, fascinated no doubt by the apparent ease with which the hand camera is worked, start their photographic career by buying one. Disillusion comes too late, and then follows the usual advertisement—"Camera for sale. Owner going abroad," &c., &c. It is of no use for such beginners to commence right away with instantaneous exposures and moving objects. They must first buy a light stand, use slow plates, and give time exposures, and so educate themselves into the mysteries of the "black art."

There are so very many varieties at present on the market that it is difficult to select one and be certain that it is the most suited for your requirements. If price is no consideration, you have a wide range before you of almost perfect apparatus. Dark slides are preferable to any other method of carrying plates if glass plates are intended to be used. Most of the "magazine" type of cameras chip the plates about frightfully, and soon produce a little cloud of powdered glass, but if films are used the dust produced is infinitesimal.

"Five by four" is, I think, the best size to get, as quarter-plate results when trimmed down tend to grow a little too small. For good results a first-rate single lens by a well-known maker will often prove better than a second-rate doublet. For 5 by 4 pictures the most convenient length of focus, taking everything into consideration, is five- or five-and-a-half inches.

The shutter should be behind the lens if possible, and should be adjustable to any speed up to 1-90th of a second. A greater speed than this you will never need, unless you go in for scientific work.

I should like to say a few words before laying down my pen on the question of exposure. Most hand camera men use their shutters at far too high a speed, and consequently their results are stiff and unnatural. This is not at all to be wondered at when we remember how slow the eye is to catch an impression, and that two or three of these rapid movements are blended by our eyes into one slower one. If we set our shutter at too high a speed, we photograph movements as the eye does not see them, and our results are false and unnatural. One-thirtieth of a second will be found quite rapid enough for ordinary, slow-moving scenes.

NEW USE FOR A FOREGROUND SHUTTER.

By W. E. Hellawell.

Photography (to get the most out of it) is full of little dodges, each man having his own pet method of doing certain things, finding that he gets just what he wants by so doing. I therefore bring this one forward with greater confidence, feeling assured it will commend itself to every serious snap-shot worker.

Many times have I had a shot at a landscape with a heavy bank of trees on one side and an open landscape on the other. Now, as every photographer knows, to expose for the trees would over-expose the brighter side, so one is driven back on the dodge of dividing the difference, and working it out in development, with sometimes none too perfect results.

This difficulty is intensified in the hands of the snap-shot worker. But I venture to hope that I have hit on a "dodge" which will help him over the style.

Some time ago I got a foreground shutter to fit to a hand camera, and as I make my own cameras I had the difficulties of adaptation to contend with. The first was, supposing the shutter to be fixed for horizontal pictures, it would be wrong when used vertically. This I thought of overcoming by cutting three circular slots in a brass plate, cut so as to allow the shutter to turn a quarter round. Then the idea struck me, Why not cut out a complete circle and allow the shutter to swivel completely round? By so doing, it allows the greatest amount of exposure to be given to the darkest portion of the picture. This I did, and find it works to perfection, and I now lay the method open to those who like me can make it for themselves. Take a square sheet of brass, and mark a circle from 5-16 to ⅜ larger than the opening in the shutter. Now cut it out, and file it up carefully with a half-round file, or better still, if you have a lathe, turn it out. Get four round-headed screws and screw the plate on to the back of the shutter, taking care that the heads overlap the plate, and that the shanks are close up to the edge of the opening. Now, after covering the plate on both sides with velvet to prevent stray light, screw it on the camera (this I forgot to do), and although I examined it very carefully, the first holiday I took most of the plates were spoilt. I therefore wish others to avoid the same misfortune. I find it works admirably, balancing the lights and shadows on unevenly lit landscapes or street scenes. I have an idea that will still further enhance its value, but as I have not yet worked it out and put it to the test, I will send it on a future occasion.

May I point out to those who do not know that a foreground shutter (to get the greatest efficiency out of it) must be placed behind the lens, and for this reason every particle of a lens is a complete lens in itself, so that if you half cover the lens in front you still have the whole of the image on the plate with less illumination, whilst if the rays are cut off after they have passed through the lens each portion of the picture gets its true proportion of the exposure. The makers sent me a before-lens foreground shutter, and I wrote and told them it was practically useless in that position. A shutter maker is putting this on the market next season, so that those people who cannot make it for themselves will be able to get the shutter properly fitted up. My advice to those who have not tried it is do so, and they will be more than satisfied with it.

HOLIDAYS IN SOUTH-WEST BRITTANY.

By Major C. Gardner Vatcher.

I was so charmed with my former trip with my camera in Brittany that I resolved to make a longer stay in one place, and chose Pont Aven as my headquarters, so packing up plates, camera, and the etceteras, we started southwards, via St. Malo. The journey is long and tiresome. Starting at 8.20 a.m. from St. Malo, one only arrives at Pont Aven at about 6.30 p.m. What makes it so wearisome is the very long time you have to spend at the places you have to change at, for instance, at Rennes you have to wait an hour, and at Redon about three-quarters of an hour. We filled up the time at the former place by taking an electric tram from opposite the station and going to see the cathedral, and close to it the "Porte Mordelaise," one of the old city gates. Rennes is also interesting from the fact that it was the scene of the famous Dreyfus trial. The stay at Redon gives you time for lunch, that is to say, if you do not do what I always advise, take some lunch in the carriage with you. Otherwise, there is ample time to see the old church, near the station, with its detached belfry, and see and take some photos of the pretty river and canal scenery. The town itself is literally dead and alive, and can be seen in a very few minutes. Arriving at Quimperle, you have to collect your luggage and take a "courier," as they call him, who drives a sort of covered waggonette, on the top of which is piled the luggage. The eleven miles drive to Pont Aven seems unending, and, what with the jolting and fatigue of the day, one arrives almost in a state of collapse. Some people stop at Quimperle the night. I would almost advise stopping there a week, as there are nice walks, one or two old churches, and pretty river scenery, and the people at the "Lion d'Or" look after English people very well, and are moderate in their charges. At Pont Aven there are only two hotels, both cheap and food good, but one, the principal resort of the French artists, is half the price of the other. I have stopped at both, and speak from experience. My chief reasons for going to Pont Aven were that the walks and drives to places of interest around were numerous, and the costume of the district, to may mind, the prettiest in Brittany. The river Aven, on which the village is situated, winds down a long wooded valley, rushing in places over huge boulders, and is used as the motive power for several mills in and out of the village. These mills grind for the district, and as a consequence there is always plenty of life. Besides which, every Tuesday there is a market held just in front of the hotels, and one sees very frequently the old Breton costumes, which, happily, are not yet done away with Even to the French it is like travelling in a foreign land, as, with the exception of the young, all talk Breton, and do not understand French. All the old customs are kept up, and I was lucky enough to see a Breton wedding at a little village about three miles out from Pont Aven, and saw and took photos of the famous old-world Breton dance. They dance it to the music of the pipe and "biniou," or sort of bagpipes. The brides, for there were two of them, were well dowered, and showed it by the lines of heavy gold embroideries round the bottom of their dresses. These dresses are heirlooms, and are only worn on special occasions. The river scenery below Pont Aven is uninteresting, but an excursion by boat is usually recommended to see the "Chateau de Henan," a pretty restored sixteenth century castle. We also took a drive, amongst others, to Concarneau ("Sardinopolis"). On the road thither there is a large rocking stone, not so large nor so easily moved as that at Huelgoat in North Brittany. There are also some ruins of an old chateau which make a pretty picture. At Concarneau, the things worth seeing are the "Ville Close," an old walled-in town, forming a sort of island in the estuary, on which the town is situated; the aquarium, where they rear fish for the sea; and the sardine tinning, with fishery. The sardine boats make at times a pretty picture, and bringing the fish ashore is very interesting. Going back to Pont Aven, we visited the "Chateau de Keriolet," a restored sixteenth-century building and show place, lately handed over by its former possessors to the Commune. During our stay at Pont Aven there was a "pardon" at Riec, a village some three miles away. This is a religious ceremony, consisting of processions round the church and village with banners, the priests sprinkling the people and houses with holy water. This is followed by High Mass at the church. Of course, the ceremony varies a good deal. I am sorry to say that as a sort of wind up there is a lot of drunkenness. The next day there were horse and other races in the morning, followed by wrestling matches, a Breton speciality, and dancing. Prizes are awarded not only for the best dancing, but for the most ornate Breton costume. Our return was uneventful, save that we stopped at Vannes, an old town with remains of the old fortified walls. This place is of interest from the fact that during the Napoleonic wars English prisoners were incarcerated here. From here we went straight back to St. Malo.

STORING NEGATIVES.

By Geo. H. Dunmore.

A simple and effectual way of storing negatives, especially applicable to the amateur, who has probably 100 or 200 to stow away, is to have two shelves firmly fixed to a wall, with a space sufficiently large to hold the plates, allowing an extra ⅛ of an inch. Then procure some of the corrugated paper so commonly used, the narrow size grooves being preferable; glue a strip of this about three inches in width on the bottom and top of the shelf space, thereby forming a most effectual, and at the same time, inexpensive plan of preserving the negatives. I have found it answer admirably. Two hundred plates can easily be arranged within a space of two feet in length, leaving them easy of access, and by marking the edge of the shelf at every tenth plate makes it still more easy to locate the position of any particular negative required, a numbered list of the negatives being kept for reference.

SHARPENING THE PRINT TRIMMING KNIFE

By F. J. Mortimer.

My contribution to this year's Annual is, I am afraid, rather brief, but will, no doubt, prove useful to a large number of photographers, both amateur and professional, as it deals with one of those unconsidered trifles which becomes a necessity. I refer to the trimming knife.

All photographers trim their prints, and whether they trim them wet or trim them dry, and whether they use a patent trimming board of the "bought" variety, or their own, the fact remains they use a trimming knife of one sort or another, and likewise the said knife gets blunt, and the prints get jagged, and the photographer gets cross, and so on; and as I feel sure not one in ten photographers knows exactly how to put a good cutting edge on a knife for print trimming purposes, I need no further excuse for dealing with this apparently unimportant subject.

From personal observation, I find that that much maligned individual, "the average man," will proceed to sharpen a knife on a stone as if he was stropping a razor, that is to say, drawing the knife along the length of the stone in a direction away from the cutting edge. At first sight this seems quite right, but no amount of "sharpening" of this sort will ever put a keen edge on any blade. The knife should be ground in exactly the opposite direction. The correct method for so doing I will describe further on, dealing first with the best kind of knife suitable for print trimming.

This should be a strong knife of the short-bladed "stocky" breed, such as a shoemaker's knife, well set in a substantial handle. The knife, however, that I prefer most of all is a good steel ordinary dinner knife—one that has been relegated to the kitchen for peeling potatoes, &c., ground down by a cutler to somewhat of this shape:—

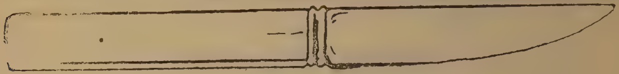


Fig. 1.

Nothing can beat this knife for general handiness and cutting qualities, and, if of really good steel, as a good dinner knife ought to be, it requires sharpening not nearly so often as the commercial print trimming knife, which is usually of iron and poor at that, and, as any cutler will tell you, it is far easier to obtain and keep a really good cutting edge on a good steel blade than on an iron one, which is comparatively soft, and, although it appears to sharpen easier, a couple of cuts on the trimming board blunts it at once.

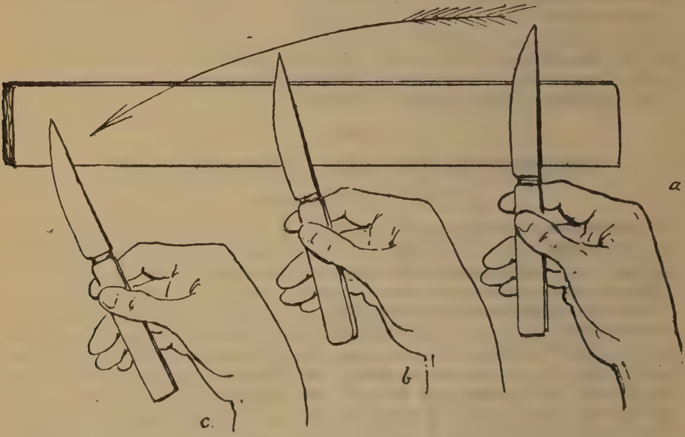


Fig. 2.

There are several kinds of stones to be obtained for a few pence from any ironmonger, cutler, or general store, which are suitable for knife sharpening, and will last a lifetime if not broken or chipped. They mostly seem to be of American origin, such as the "Canadian oil-stones," which are a species of limestone in varying degrees of fineness. Get a fairly coarse one. That known as a shoe maker's stone or "snob's lapstone" is excellent. It resembles a long piece of fine grindstone about 9 × 2 × 2 inches. A stone, also, that I have found splendid for the purpose is a flat scythe stone, about a foot long. It is known, I believe, as "Indian pond," and is of a metallic blue grey colour. It is described as a petrified wood, and it certainly has a distinct grain. No. 1 is the best degree of fineness for our purpose.

The correct way to sharpen a knife such as I have described, and, in fact, practically every kind of small blade, with the exception of razors, which, being hollow-ground, require a slightly different treatment, is as follows:—Take the stone by one end with the left hand, and hold it at a slight angle on a firm table or bench. Take the knife in the right hand and lay the heel of the blade, *i.e.*, the part nearest the handle, flat on the lower end of the stone, with the cutting edge towards you, as at

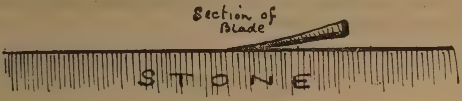


FIG. 3.

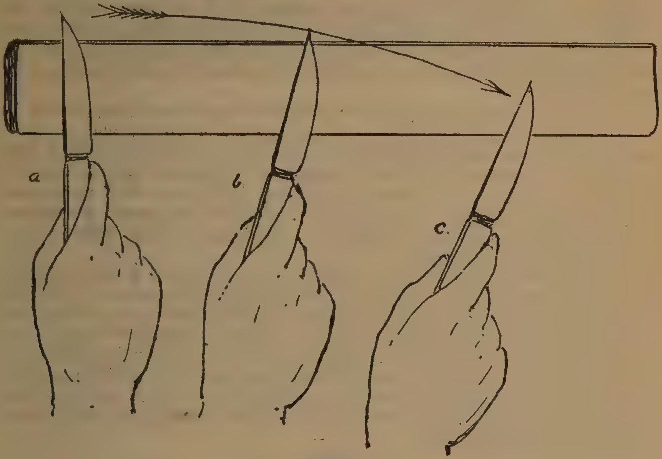


FIG. 4.

a in fig. 2. Then raise the back of the knife just a trifle, and keep the edge firmly on the stone, as in fig. 3.

Then with a sweeping circular kind of stroke draw the blade firmly and quickly from heel to point, finishing at the other end of the stone, as in fig. 2.

Repeat this until you obtain the right angle to keep the blade with the stone, and then turn the knife over, and repeat the motion in the opposite direction, as in fig. 4.

Keep on treating each side of the blade thus until sufficiently sharp, and then, if necessary, a still finer finish can be obtained on a finer oilstone, with a little sweet oil, proceeding in exactly the same way as with the coarser stone.

The exact amount of pressure, the exact angle to hold the knife with the stone, and the necessary circular forward motion, which is easier done than described, will be soon obtained with practice, and a perfect edge once obtained can be retained with very little trouble, making print trimming a pleasure.

SELF-HELP.

By Rev. B. Holland.

I desire to advocate in a short paper what appears to be neglected, even by many who are enthusiastic in their attachment to their photographic hobby. The last few years the ranks of amateur photographers have been extending by leaps and bounds, but it is presumable that numbers of them are content to have their needs supplied by the numerous dealers who, to judge by the scores of cameras one sees about, must do a flourishing trade.. Now, why should not personal application and skill be utilised to educate the worker and save the purse? All, certainly, are not clever cabinetmakers, yet it is astonishing what even a heavy hand can do in the way of putting together apparatus, and when it is wanted chiefly for home use the clumsiest contrivance proves serviceable.

But there is another direction in which the amateur should work. I refer to plate making. The gelatine process is so simple, so much under the control of the most inexperienced chemist, that with a little care and patience very excellent plates can be prepared by any one who will devote a few spare hours to the task. This was well understood by those who laboured to bring the process to its present perfection, and it would be a practical education if younger workers would endeavour to follow in their steps.

It would occupy too much valuable space to give working details here, but some of the old Almanacs teem with information, which will enable the merest tyro to provide himself with plates at a trifling cost that will yield quite as good negatives as those for which he pays considerable sums. Perhaps, of all volumes, the Almanac for 1883 gives the most precise directions, and if this, or others, be carefully studied, and the directions followed, success and gratification will surely reward those who take up what is undoubtedly a fascinating and, at the same time, a profitable pursuit.

CAMERA BACK FOR TOURISTS.

By W. Girling.

At a meeting of one of the societies the question was asked why so few of the pictures taken on the organized outings were exhibited? The day may not be the most suitable, or the light not at the best, for the subject when you are there; there is the presence of others, sometimes where you do not want them, deference to their opinion, against your own judgment. Time being limited, one cannot wait, so the best is done that circumstances permit, whereas the premier pictures are not so obtained. Generally, they require watching, waiting; perhaps the scene or building has to be visited three or four times before the best is seen. In fact, touring is better accomplished with a friend or two of like enthusiasm; upon such occasions, obviously, as little impedimenta as possible is taken. Those with an outfit not smaller than ½-plate size, sometimes find their plates larger than they require for the particular bit before them—one half the size would be ample. If another camera and backs be out of the question, the following piece of apparatus I have found simple, easily made, and efficient:—Get a flat piece of close-grained wood, mahogany is preferable, about an eighth of an inch thick, cut it to fit the camera where the slides go in; upon the centre of this lay a plate of the size required, mark round it, and cut the piece out; place the smaller back over the aperture; take three strips of wood half-inch thick of sufficient width to fill the space between the back and the camera, cut away a small piece from the under sides to fit the projecting sides of the back, accurately fasten them to the first piece of wood so that the back can easily slide in and out, and put a hook or button on the camera to prevent the back coming out when the slide is drawn.

Of course, a screen must be made in a light frame the size of the smaller back, and in register with it.

The whole affair will not be so heavy as a loaded slide, and will enable three double backs to be carried in the pocket with very little extra encumbrance.

PLATE SPEEDS AND THE LIMITATIONS OF THE HURTER AND DRIFFIELD SYSTEM.

By H. J. Channon.

A feeling exists among many amateur photographers that they have a great grievance against the plate-makers in respect to the marking of speeds. Instead of worrying their customers with the Hurter and Driffield and all sorts of other methods, why, it is asked, cannot the plate-makers agree among themselves to mark the speeds upon the boxes in such a manner that the buyer of any plate would always know exactly how quick it was? This seems a fair demand, but it is nevertheless asking for an impossibility; the work of various investigators has well established the fact that speed is not a property of the plate alone, but depends very much upon the use which is to be made of it and the treatment it is to receive, so that the ratio of the speeds of any two plates to one another might be found to alter greatly under varied conditions.

It would certainly be advantageous if the plate-makers could so arrange as to all adopt one uniform method of speed-testing, but, assuming that done, we should only arrive at approximate results. Certain standards would have to be definitely fixed, such as the kind of illumination (necessarily artificial), composition of developer and manner of development, definition of speed, &c. All these standard conditions of testing would certainly be widely departed from in practical work; every deviation seriously affects speed and does not affect all plates alike; hence speed-numbers, however arrived at, although they may be very useful guides, are decidedly fallible ones. The Hurter and Driffield system appears to be decidedly the most scientific and satisfactory mode yet suggested of indicating speed, and its general adoption is to be wished for, but the true meaning of the speed numbers employed needs to be clearly understood. Messrs. Hurter and Driffield started with a definition of what constitutes a "perfect negative," which seems quite satisfactory from a scientific point of view, and their system measures, relatively, the exposures required by different plates to obtain such a negative in the shortest possible time. Now, so long as the production of this "perfect negative" is the aim of the photographer, the Hurter and Driffield system stands on a firm basis, but it must be stated in the first place that such a negative is by no means the ideal of "artistic" photographers of the present day. Suppression of detail is quite against the definition, and when accomplished, as it often is, by deliberate curtailment of exposure, results in a species of photography in which the authors of the system took no interest, and to which their principles do not apply. When pictures of the type indicated are to be made, the Hurter and Driffield speed-numbers must not, then, be regarded as trustworthy. We have in snap-shot work, I think, another branch of photography where they are not to be depended on. In writing about this branch, I must state that I have had no recent experience of it. Nevertheless, from old recollections, I feel extremely sceptical as to the value of warnings, which are sometimes given of dangers from over-exposure. My belief, in fact, is that our plates are still too slow for really satisfactory shutter work, unless under exceptionally favourable circumstances: that nearly all work done in this line is under-exposed, and generally seriously so. I was interested recently to find this opinion of mine strongly confirmed by a statement of Mr. Alfred Stieglitz, that of tens of thousands of hand-camera negatives which he has seen during a long experience, "fully ninety-nine per cent. were under-timed." In the Eastman Exhibition of 1897, we had the cream selected from the twenty-five thousand examples of this kind of photography which had been sent in for competition, and certainly, to my mind, the result was most disappointing; in fact, after a rather prolonged examination of that section of the exhibition, I left the gallery in considerable doubt as to whether among all those thousands of snap-shots one really satisfactory picture could be found. Under-exposure was everywhere conspicuous. The moral seems to be that that defect is usually unavoidable, hence, in this class of work, we must strive by all means in our power to bring out the best results possible from insufficiently-exposed plates. Under these conditions we have departed from the bases on which the Hurter and Driffield system depends, and the speeds, according to it, can no longer be relied upon. Messrs. Hurter and Driffield's own investigations have clearly shown this. They have shown, that is to say, that if one of two plates have a higher speed-number than the other, it is not necessarily the former which will produce the better negative when circumstances do not admit of proper exposure being given. True gradation is then impossible, and the principal aim must be to secure a fair amount of detail; but the plate with the lower speed-number may be the better fitted for that purpose. The best test of speed for such work is probably still given by the old forms of sensitometer of the Warnerke or Spurge type.

The Hurter and Driffield system is also, perhaps, too readily regarded by some of our scientific investigators as indicating the absolute sensitiveness of plates. It is true an attempt was made in the original paper to show that "speed" depended on the "inertia" of the Ag.Br. in the plate, but that part of the paper was far from satisfactory; the point certainly cannot be regarded as demonstrated, and to treat it as an established principle in investigations seems a course likely to lead to erroneous conclusions.

SLOW OR RAPID PLATES.

By W. T. Wilkinson.

To beginners with a stand camera, the advice to use only slow plates is quite unimpeachable, but the dictum, "Always use slow plates for everything," is quite wrong.

When the above dictum was first coined the manufacture of dry plates was only in its infancy, and the extra-rapid plate was anything but easy of manipulation, i.e., from the point of view of being free from fog, but nowadays plate makers will give you plates of the very highest speed which can be developed as free from fog as a photo mechanical plate.

We have had a fine summer, with many tempting days for photography; for instance, Whit Monday, lovely day, lovely hedge-rows, all in blossom, but what a wind. I was out armed with camera and 24 plates, 12 ordinary slow (f-45 Wynnes) and 12 very rapid 210 H. and D. (f 156 Wynne). Actinometer gave for the slow plates, lens f-16. ½ a second. Well, I could not get a ½ second free from movement, so used the rapid plates at 1-32, gave 1-10 of a second, and got results free from any sign of movement.

Out of all my excursions this summer (always taking slow as well as fast plates), I have used the fast plates in the proportion of 25 to 1.

Of course, rapid plates require greater care in the dark-room. They should always be put in the slides in pitch darkness, and they should not be exposed to the light in the developing-room until they have been in the solution at least three minutes. Again, for rapid plates, always use a little extra bromide and sulphite. These will keep off surface fog.

For developing, I have now quite discarded pyro, and taken to ortol, which gives identical results, without the staining, and without the tendency to hardness, if the exposure is short.

Katchin I have tried, and so far like it very much, especially for over-exposed plates, as the borax restrainer is so powerful, and does not give the clogged shadows that a large dose of bromide would.

I enclose prints from some of my negatives taken on windy days on Cadet-Spectrum plates, 210 H. and D. for your opinion as to whether a slow plate would have given better results. They were all developed with normal ortol, put into developer, covered up, and taken out without any critical examination; in fact, just developed by Watkins' time method.

[Technically we could find no fault with the prints sent. Ed.]

THE CHOICE OF A PICTURE.

By the Rev. S. Whittell Key, B.A.

I dare say I shall be accused of travelling over well-beaten ground when I write a few words of advice about the selection of a picture to be taken by the amateur. I have so often observed, especially among beginners, the fatal mistake of attempting to take subjects which are too difficult, and far beyond the scope of any ordinary photographer. Only the other day I was staying with a friend who persuaded me to attempt the almost impossible task of photographing a group of people sitting at a long dining-room table covered with a white cloth, my position with the camera being outside the open window. The result was, of course, as I had anticipated, the far end of the table with its occupants was very much under-exposed, whereas those seated near the window were exceedingly over-exposed. Some people have the erroneous idea that a camera will and must take any object or objects before which the operator chooses to place it. This, however, is by no means the case. The subject must be adapted to the capacity of the lens employed. As most amateurs, I believe, work with a rapid rectilinear or landscape lens, let us suppose we are going to take a picture with the

apparatus in question. If it is to be a view, try and select one where you have your objects grouped as close together as possible, so as to avoid the combination of long and short ranges of focus; but if this be unavoidable, stop down the lens as much as possible, and lengthen the time of exposure accordingly. In the case of a group where you can move the figures *ad lib*, avoid grouping them in rows, one in advance of the other, rather form them in a semi-circle (where there are a large number of figures), and use a small stop. One word more. Always focus some object between the centre and corner along one of the diagonals of your view or group, and to obtain a greater degree of sharpness, well scrutinise the object upon your focussing screen through a magnifying glass. To any one who may say that a small stop needs too long an exposure in photographing an animal, for example, I submit the accompanying print, the negative of which I took at the latter end of August, upon an Imperial ½-plate, speed No. 200, stop *f*-45, exposure ¼ second, time of day 4 p.m.

COMPETITION.

By J. A. Reid.

Most people are engaged in the business of endeavouring to keep pace with life; and this, in these days, is somewhat difficult. It is generally agreed that a certain amount of competition is beneficial. There is, however, a limit to profitable rivalry, and precisely where this limit begins and ends is a matter for economists. Although the writer does not include himself in the latter category, a few points, briefly referred to, may be of some interest.

In the photographic trade, as is well known, there is an institution known as the Plate Makers' Association, whose business it is to prevent indiscriminate cutting of prices. Although the leading plate makers have uniform prices for their goods, the effect of competition makes itself evident in other directions. Thus some manufacturers inform you that their plates are superseding all others. Possibly there may be room for scepticism. If not, it is surely a bad look out for somebody.

At one time, there were considerable discussions respecting the injury that amateurs did, or were alleged to do, to professionals. In view of some of the pessimistic utterances made, and the army of amateurs now in existence, one would have imagined that the professionals would have been swept out of existence by this time. Professional photographers, like other people, have to adapt themselves to circumstances. It cannot be said that as a class they are particularly solicitous of each other's welfare, and it is not so much the amateur that has to be feared as a "brother" professional. In many provincial towns, there are already more photographic establishments than the needs of the population demand, but it would not be difficult to find instances where fresh rivals have entered the already crowded field, the natural consequence being that somebody has to go to the wall. Other things being equal, the race is to those who can afford to advertise the most.

It is generally agreed by persons who do not photograph at all that the amateur certainly does cause a very serious diminution in the profits of the professional. It may be so! But I think we can take it that the larger number of amateurs do not pursue photography with any desire to injure the interests of the professional. And the latter class have one consolation, if consolation it be, that there are other occupations in which the apprenticeship is sterner, and the competition still more severe.

Naturally enough, the manufacturers, and the very considerable class who cater for the amateur, enlargers, the publishers of photographic literature, &c., have no cause for complaint that the pursuit of photography is so popular amongst the general public.

The advertisement pages of this ALMANAC have their own tale to tell. It is generally recognised that most of the best photographic apparatus procurable is made by English firms; and, doubtless necessarily, it is perhaps the most expensive. Most people soon learn, however, that the most expensive things are frequently the cheapest in the long run. The Americans seem to be adepts in the art of manufacturing light, inexpensive cameras, which seem to suit the purposes of a considerable portion of the large number of snap-shottists. The American types, or at least some of them, seem to have come to stay. This means, of course, more competition for English manufacturers, who, though handicapped by tariff laws in America and elsewhere, should certainly not rest content to be beaten on their own ground. Those competent to express an opinion are confident that where a camera is to be used continually for really serious, practical work, the best English-made goods cannot be beaten. But there is a large class who only use a camera occasionally, and amongst this class, particularly, the American cameras are popular.

Stress of competition and lack of orders may cause photographers to cater for amateurs when, probably, if they consulted their own wishes, they would prefer to confine their attention to the practical pursuit of photography. If the restriction, "That, in order to secure dealers' terms, they must relinquish professional photography, and trade as dealers 'pure and simple,'" ever existed, it is probably now a dead letter, for there are many establishments which cater for the wants of the amateur in every possible way, and where at the same time professional photography is pursued to a considerable degree. In small towns, it is very questionable whether a photographic goods dealer "pure and simple" could exist. In any case, he would find the chemists formidable rivals, for most pharmaceutical establishments sell photographic requisites. From one point of view, to expect photographers desirous of trading as dealers to relinquish professional photography in order to secure dealers' terms, would be just about as ridiculous, or as logical, as to expect manufacturers to cater for the amateur or the professional, but not for both.

It is said that variety is the spice of life. We certainly have the former when dealing with photographic goods. Of varieties of cameras, lenses, etc., we have an almost bewildering number. "Pay your money and take your choice," may be the dealers' motto.

It is competition, doubtless, which is responsible for the desire on the part of the Editors of the illustrated press to reduce the reproduction fees of photographers to a figure unprofitable to photographers. Some Editors adopt all manner of schemes to obtain photographs of decided general interest cheaply; and the journals to which it is worth the while of those who pursue photography as a profession to contribute their work, are comparatively few. Undoubtedly, the amateur is greatly responsible for this state of affairs.

HALATION AND ITS PREVENTION.

By William Fleming.

A great deal is said and written at the present time about halation and the prevention of same by means of one or other of the messy compounds used for backing plates. Some of these compounds, no doubt, answer excellently well, but they are all more or less troublesome to use, and if a little more care were taken with the ordinary means adopted for separating plates in the dark slide, in many instances it would not be necessary to use backed plates at all.

Too little attention is usually given to the medium used for separating the sensitive plates in the double dark slide, and if photographers would but see that a proper substance is used for separating the plates, there would be a considerable lessening in the number of good negatives spoiled by halation.

The usual piece of cardboard or metal plate with springs on it can be very much improved upon, and that at the expenditure of little labour and little or no expense if the following method of procedure be adopted. Procure a piece of cloth of a fairly good quality and weight, and preferably of dark brown colour. Cut it up into pieces corresponding to the size of plates used, then take a number of pieces of stiff cardboard, and for each piece of cardboard set aside two pieces of cloth. Coat both sides of each piece of cardboard with thin glue, and immediately it becomes tacky or sticky press into contact with it the pieces of cloth, one on each side. Smooth the cloth out neatly, and allow it to dry thoroughly. If the edges should be ragged a little, trim them carefully with a sharp knife, and at the same time see that the size is rather under than over that of the plate, as by that means future trouble in the dark room will be avoided.

A supply of the above pieces can be kept handy, so that, in the event of coming across some extra thin plates, two or other number of pieces can be used in place of one, thereby bringing the plates properly into focus, and at the same time preventing that disagreeable rattle sometimes noticed when inserting a slide in the camera. Plates loose in the dark slide, by the way, very often lead to particles of dust, or the like, on the negative.

The advantage of using the above method of separating the plates seems to lie in the fact that the back of the plate is brought into such close contact with the surface of the cloth that very little diffusion of the rays of light takes place behind the film.

TO CARBON TISSUE PRINTERS.

By George Bankart.

Just a few words to beginners in carbon tissue printing, which may possibly save them annoyance in getting defective prints.

One of the minor troubles I experienced in early carbon work was "blisters," not large and prominent ones due to careless squeegeeing, but very minute blister specks in thousands all over the face of the print, making it look and feel to the touch as if sprinkled all over with sand from a pepper-castor. I traced them to the use of tap water for the operation of squeegeeing the exposed tissue to the support before development.

Tap water from service mains always contains more or less compressed air, and, where the service is intermittent, often in large quantities. I have seen it come out of a tap looking like milk and water, or soda water, and if this is used for squeegeeing tissue to the support, even after standing for some time, the moment the tissue is immersed in the cold water the air rushes out and attaches itself to the face of the tissue in such minute globules that it is not perceptible, and gets imprisoned between the tissue and support by the act of squeegeeing them together.

The "blisters" are not perceptible until the print is nearly fully developed, and then the heat of the water expands the globules of air, and they force up the surface of the tissue in the form of minute "blisters," which, though they may partly dry down in the dried print, leave a series of small spots of unequal density, which are highly detrimental to the finished picture.

The remedy is always to use "soft water" (rain water) pumped from a cistern or drawn from a tank for the squeegeeing part of the process, and if it can also be adopted for the hot water developing bath, it has a much pleasanter solvent effect on the tissue than many "hard" tap waters, and leaves the finished print with a fine velvety surface of great beauty in half-tones. Rain water contains more sooty and dirty impurities than tap water (except that the latter often contains quantities of oxide of iron in fine particles which attach themselves persistently to the soft print), but if it is pumped into a can with a round spout, over which three or four folds of fine muslin can be tied, it may be roughly filtered from all impurity likely to affect the print. Therefore, I advise to avoid tap water, and use rain water whenever possible.

Devotees of the gum bichromate process lay emphasis on the fact that "brush development" is available to a large extent in producing artistic effects. This is true, but it seems to be ignored that similar treatment is quite possible with ordinary carbon tissue printing—perhaps not to the same extent as in "bi-gum" work—but a very soft brush used with a light touch is exceedingly useful in brightening up a high light, or a cloud, or in reducing the opacity of a heavy shadow. The gelatine surface is very delicate in the hot soft state, and requires careful handling not to leave brush marks, but it is quite easy to work the brush, especially if the surface of the print is kept a little below the surface of the hot water during the process. This gives considerable scope for artistic treatment of carbon prints which is not available for any of the printing-out papers in silver compounds or in platinotype (except when glycerine local development is adopted).

To those who try the use of a brush in carbon work, I would say, Don't be rash in using it, but try gently and tentatively at first, lest scratches and breaking up of fine lines in the detail work should happen, and only adopt the brush when it becomes imperatively necessary.

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BACKGROUND HANGING.

By J. A. Randall.

Various methods have been suggested for suspending backgrounds, and the one here described may not be novel, although it is not largely known to the profession. I have seen, and used, many different contrivances, but this, after giving it a trial, appears to me the most handy and compact for commercial purposes. It is applicable only to backgrounds which admit of being rolled. Each background is affixed

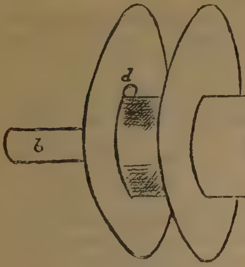

Fig. 2.

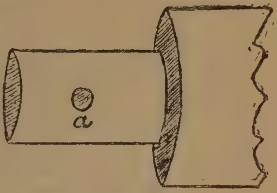

Fig 1.

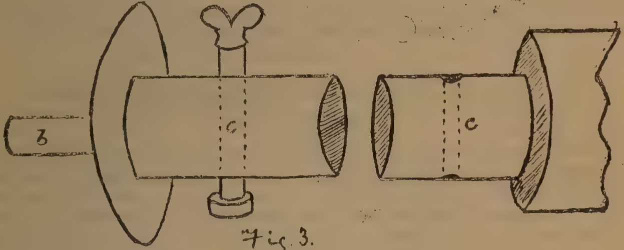

Fig. 3.

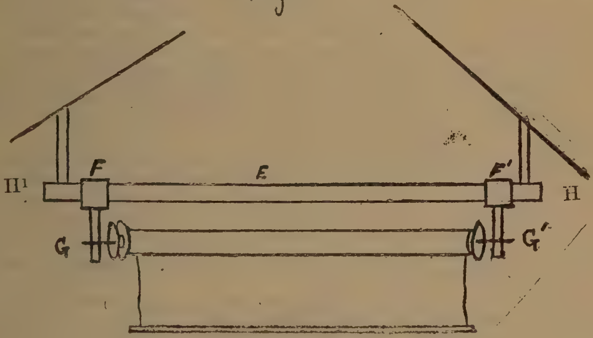

Fig. 4.

to a stout roller, the ends of which are shaped as shown in fig. 1, a hole being bored through the smaller diameter at A, the purpose of which will appear later. Two metal cylinders, some four inches in length, with flanges attached, are then made; the first with two flanges (fig. 2), the second with one (fig. 3). At the end of each cylinder an iron rod is fixed, B (figs. 2 and 3). A hole is drilled in each cylinder, and a screw and nut made to fit (fig. 3).

The space between the two flanges (fig. 2) is for the purpose of winding cord upon, to raise and lower the background. At D (fig. 2) an aperture is pierced to pass through the cord, and a knot made to secure a hold.

These cylinders are fitted over the smaller ends of the roller, the screws inserted, and the nuts fastened to hold them together. The background thus prepared is hung as shown in fig. 4. E is an iron bar running the width of the studio. F F' two iron runners sliding along the bar. At G G' two holes, into which the rods B B on the cylinders work.

To change a background it is thus only necessary to remove the flanges, and affix them to any desired background, whatever its width; 6, 8, and 10 feet rollers can, therefore, be used on the same bar by altering the distance between the runners.

To still further increase the utility of the arrangement, the bar E can be made to move along the length of the studio by supporting it at the points H H' on a bar, instead of from the roof, as shown in fig. 4

A DRAWING-ROOM EASEL FOR PHOTOGRAPHS.

By J. McIntosh.

When the camera is used at regular and frequent intervals throughout the year, the industrious photographer who makes a print from each negative is brought to face the question, "What is to be done with the ever-accumulating prints? How are they to be stored in a convenient way for reference?" Want of space forbids that they should all be framed, and albums are expensive, and not always suitable. A very good plan when working in platinotype or in carbon is to mark the negative, and in the first case to print, and in the second to develop, the prints upon sheets of paper large enough to allow a considerable margin round them. They may then be stored in a large-sized portfolio (preferably one with a spring back), and this in turn may be supported on a light easel of bamboo.

Such an article need not be expensive, and as the bamboos can be bought in lengths of from six to ten feet, may be easily constructed by the photographer. One side of the portfolio should be attached to the easel in such a way that when the other side is lowered, and held in the position by tapes or ribbons at the sides, it will form a shelf on which the prints will lie. For inspection the prints may in turn be placed reclining against the back.

The plan has several advantages; as the large sheets of paper are a little costly, only the best work is likely to be preserved. A number of prints can be stored in a small space, and are kept clean; they can be examined free from the objectionable glaze and other disadvantages of glass, and, finally, the easel is far from being an unsightly article of furniture, and is easily moved from one room to another as may be required.

STOCK SOLUTIONS.

By C. T. Sutton.

A great deal of time is saved by working in a systematic manner with solutions of the various chemicals used in photography. Amateurs, especially, say what a trouble it is to make up a solution every time it is wanted, and admittedly this is the case, if only the required quantity is made up each time, as there is the weighing-up, which is a trouble in small quantities, dissolving, and very often filtering, to be done; but, on the other hand, stock solutions of most, if not all, chemicals can be made up to the requisite number of grains per drachm, ¼oz., ½oz., or ounce, as occasion necessitates. Thus, supposing 25 grains of a certain chemical are required each time, a stock solution should be made up at the rate of 25 grains per drachm, if possible, so that it will take least space, or, if the chemical is not soluble in that amount of solvent, ¼· ½, or 1 oz. of solvent should be used, then for every drachm, ¼, ½, or 1 oz. of solution taken, 25 grains of the chemical will be obtained, which may then be added to the necessary amount of water or alcohol. Certain precautions are necessary when making stock solutions, such as using distilled water for the noble metals, gold, silver, and platinum, keeping them in the dark, and only making up small quantities of chrome-alum, citrates, &c., which are liable to decompose in an aqueous state. Alcoholic solutions may be relied upon to keep well, no matter what chemical is used, but with water as the solvent it is different, as many chemicals speedily decompose, when in an aqueous solution, especially those which are of an organic nature, but if these points are attended to, no trouble need be apprehended.

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REVERSAL JOTTINGS.

By J. Dormer.

The reversal of the photographic image is a phenomenon which deserves more attention than it obtains. To produce a positive or negative at will on any brand of plates would be advantageous in many cases. Occasionally only a single positive is required at the moment, and when an enlarged negative is to be made the production of a positive in the first place would save time and render changes in the values less liable to occur than when a transparency is made from a negative as a preliminary. At present, when a photographer snap-shots, say, a partial eclipse of the sun, and finds the solar image in his negative a transparent instead of opaque disc, he is inclined to regard it as an unmitigated nuisance. A man may be admirable as "a soldier and sailor, too," but a negative which is partly positive is a kind of a "giddy harumfrodite," which is distinctly not acceptable.

Photographic reversal has been known since 1839, when Lassaigne, and afterwards Herschel, observed it; and though later experimentalists have investigated the phenomenon at various times, the theory is still somewhat incomplete, and hardly any practical use has been made of the fact. Certain chemical reagents obliterate the photographic image in the dark, and certain photo-chemical reagents obliterate it in the light. Not only is prolonged exposure to light capable of reversing the image, but prolonged exposure to the vapours of such substances as peroxide of hydrogen and dipentine has the same effect also. By prolonging the exposure to light of gelatino-bromide plates, it was found that, on development, zero, negative, zero, and positive states occurred, the latter states requiring greatly augmented intensity of the light. Recently Professor Nipher has called attention to the great latitude of exposure which may be obtained by reducing the plate to a zero condition (i.e., that in which it does not darken when placed in the developer) by a preliminary exposure to light previous to inserting the plate in a dark slide. A plate so treated, he says, may be exposed on a landscape for any length of time up to four hours with superb results. Any tendency to fog is corrected by placing the developing bath nearer the light. This recalls to mind Sabatier's method of obtaining reversal by exposing the plate to light when partly developed, though it hardly comes into the category of true reversal on account of the part played by the developed portion.

In conclusion, it may be mentioned that the use of rapid plates facilitates reversal; oxidisers favour it, reducers do not; and where a weak developer would give an ordinary negative, a strong one may yield a positive. There is, however, still room for considerable experiment in the production of negatives or positives at will.

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CYCLING AND PHOTOGRAPHY.

By W. Hampson.

These two pastimes can be successfully combined, although, to read some of the articles published, one would think it entails great discomfort and some curtailment of speed. Possibly this view arises from the fact that many of the writers are only armchair critics.

After much experience, both personal and otherwise, I advocate the quarter-plate size, either fitted with dark slides for cut films or a roll-holder for spools. This year having seen the production of various makes of spools at reasonable prices, I have had fitted to my quarter-plate Xit camera a Kodak roll-holder, and it proves perfect and convenient in every way.

The camera and roll-holder fit in a bag, which is fastened to the cycle beneath the saddle, and on the chain stay on the opposite side to the chain is fitted a Crown cycle rest. This enables the cycle to be used as a tripod. On the handle-bar is fastened a ball-joint camera top, which allows the camera to be placed at any angle. I have cycled with non-photographic friends, and they have not complained of any delay, and as I like to cover from 70 to 100 miles, and expose a spool of 12 exposures in a day's outing, I consider this arrangement both practical and convenient.

I have used Sandell spools, and have only one complaint to make against them—that is they might be made a little more sensitive, and, if possible, isochromatic. The Kodak roll-holder allows the image to be seen on the screen if desired in the same manner as using a dark slide. This is valuable for interiors and set subjects.

ON THE PERMANENT MOUNTING OF PRINTS: A SUGGESTION.

By Richard Thirsk.

Most of us at one time or other feel the need of a handy and compact method of storing away prints. Some, for lack of anything better, never mount a print simply because, unmounted, they can be packed without taking up much space, or adding any considerable weight. Yet we cannot take any particular pleasure in unmounted prints. They are not quite finished or nearly so attractive as they might be, and, besides, they soon get dry, then crack and tear. Mounting each singly is a very common practice, but boards are, as a rule, thick and heavy and apt to go astray just when wanted. To give completeness and uniformity to a series of prints, it is necessary to have them gathered together into an album, so that we may conveniently turn over the pages, viewing each print to advantage without unnecessary trouble.

There are many albums in the market, some good and some bad. For instance, there is the "slip-in" album, which has been condemned over and over again. Because only taking prints of a certain size it is not considered "artistic." Then there is the substantial album, leather bound, having a thick board on which you can mount several prints. But even it is not "artistic." Seldom or never it is advisable to mount more than one print on a page, except in a scrap album, and, as the leather-bound album is cumbersome, it seldom finds favour, except on a drawing-room table. The ideal album should have interchangeable leaves, easily added to or taken from without disturbing the binding or destroying the album.

Now that the winter is quite with us, and we will be on the look out for a suitable method of keeping our collection of summer pictures together, the following suggestion may not be out of place.

Some time ago a series of "art-boards" for mounting photos was placed on the market. These are to be obtained in several shades, calculated to suit any tone, and in size varying from 8 by 6 up to 15 by 12. Their chief utility for the present purpose is that they are very thin, only two sheets thick, therefore light and flexible. The idea is to mount the photographs on these, and afterwards bind them.

For the sake of convenience, we will suppose that ½-plate or ¼-plate prints are to be mounted on the 8 by 6 boards. The prints are mounted in the usual way except that when starch is used it is advisable to rub a damp sponge all over the mount, front and back. This will prevent cockling, and in order that they may be kept flat it is advisable to place them, when almost dry—not tacky—under pressure.

A glance at fig. 1 will explain the position of the print on the mount. It is kept well to the right in order to leave sufficient space on the left to cut out the two little holes that are to bind it to the others.

When the prints are mounted and dry take one of them and cut two small holes in the mount, not shown in illustration. These holes should be about half an inch or an inch from end and sides—that is there will be four or five inches between each hole. As it is of the greatest importance that these holes should be in exactly the same position on each mount, it is safest to use the first one to be cut as a guide, placing it evenly on each mount and marking the position of the holes with a pencil. This done, the mounts are ready for binding, and may in the meantime be laid aside.

Now, about the binding boards. Choose two stout pieces of cardboard, and trim them down to within half an inch each way of the size of the mounts. These should next be covered with what is known as morocco paper, which may be obtained from any stationer or fancy box maker. As this paper is manufactured in almost all colours, it may be well to advise the novice to choose only very quiet shades. Cut a piece of this paper a little larger than the board, so that it will easily overlap all round, and, using very thin glue or gum, paste it on to the board—coloured side out, of course. Do not rub too hard when pressing it into contact. See that no air-bells are left, and be careful to make a neat job of the over-lapping, particularly at the corners, where the paper should be trimmed down so as not to bulge.

Fig. 1.—A Country Lane.

This completes the outside of the board, and all that remains to be done is to paste a sheet of white paper on the inside, so as to cover up the ragged edges of the morocco paper. The sheet of white paper must be evenly trimmed, and should not come quite to the edges of the board.

Some time ago I was commissioned to do some photographs for a bazaar, and, taking advantage of the khaki rage, made some inexpensive albums, without employing the method above described. Round the edges of plain, dark-coloured straw boards—such as are sent out with bromide paper—I pasted narrow strips of red paper, and, to make them look even more bookish, finished off the corners with pieces of the same colour. (See fig. 2.) The idea was simplicity itself, yet it took immensely, and I have since noticed several amateurs repeating the suggestion.

Once the morocco paper and white paper have been pasted on the board it will be, in appearance, like a stray book batter. (Bear in mind there must be two boards for the album, one for the front, the other for the back.) Take one of the mounts, and placing it in the centre of the board, mark off and cut out the holes—same as in mount. A very sharp penknife will easily go through. Now, place the mounts and the boards together, and pass a cord through the holes, tying it loosely where it meets in the centre, and the album is complete. The cord, or ribbon, that you choose, should harmonise with the colour of the board. It may be either fastened, as suggested, else two separate pieces of cord may be used.

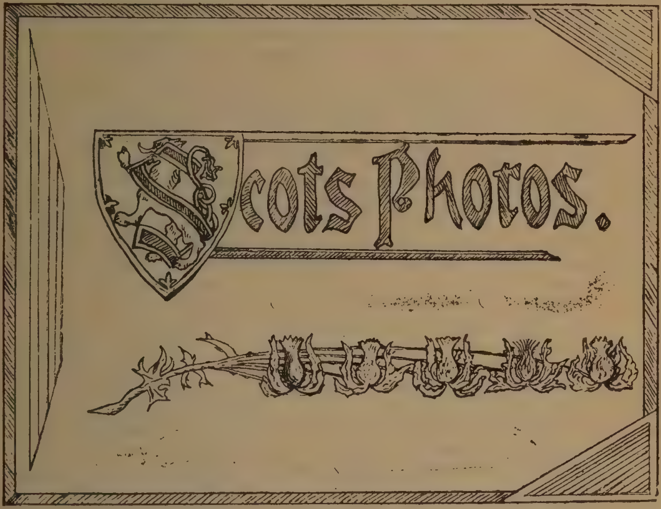

Scots Photos.

Fig. 2.

Photographs mounted in this way can be easily turned over in the album, and when it is thought advisable to alter the arrangement or add other mounts all that is necessary is to undo the cord. This is certainly an advantage over the bound albums; but perhaps it will most recommend itself to those to whom expense is a consideration. Including mounts, boards, paper, and everything, the album cost only eightpence; time occupied in making it, about half an hour. A further point in its favour is that you can mount in it any shape or size of print, from the size of the mount downward.

With a little extra trouble the boards may be made more elaborate, and better suited to binding. Cut a piece of stout linen or canvas six inches by three or four; breadth of the cloth will determine thickness of album (these sizes are for the 8 by 6 mount). Run a narrow strip of strong glue down one end of each board. Lay the cloth out flat, and place the boards in contact, one on each side, leaving the required space between them, and only sufficient overlapping the boards to give it a firm hold. This, when bound, will resemble the batters of a book.

For the rest of the process, it is the same as that already described for the single boards, with only this difference. You must lay the bound boards out lengthwise, cut the morocco paper the full size, and cover both boards, also the cloth in one piece. The white paper pasted inside is also kept in one piece. Puncture holes in this, and tie in the same way as the single boards. This extra binding serves to make the album more rigid, keeping the mounts from having too much free play, and is therefore worth the trouble, which is inconsiderable.

There is yet another method of binding that does away with the use of the cord, but a description of it would occupy much space. If the photographer works out the above suggestions, other methods of binding will, no doubt, readily suggest themselves, and, since the variety is infinite, he will find much scope for individual taste.

As for ornamentation, that entirely depends on the individual. A mount on which some design is drawn may be inserted in the front. To introduce an album of Scotch views, we cut the "Red Lion" out of an old print and pasted it on to the title page. The contents page can be neatly written, but there is scarcely any need for such a page, as the title of the picture may be written along with descriptive matter at the bottom of the mount. Though it is perhaps as well to have the outside of the covers plain, printing may, if desired, be added. Our khaki albums had a suitable inscription printed on the covers in red ink, which was in keeping with the other features. The word "Photographs" will be found in almost every magazine. Cut it out, stain the paper to almost the colour of the board on which it is pasted. This will hint at what is in the album, and if you want to state exactly where they are from, the idea of cutting out the type and pasting it together may be followed out.

◆

ROUND ABOUT LA ROCHE.

By Wilford F. Field.

Far removed from the world's highway, nestling coyly in a luxurious setting of emerald and kissed by the bubbling Ourthe, is La Roche. For the tourist, be he pedestrian, botanist, or photographer, there is a fine field; indeed, after years of globe-trotting, I am inclined to pin my worship to this latest idyllic resort.

The sun-artist, equipped with plates or spools, will have no cause to complain of the paucity of subjects, for at every step one catches some "bit" worth reproducing in one's view-volume.

And being at La Roche, it is the thing to do to go to Le Herou—a gloriously picturesque waterpiece not far off. Then there is Maboge, pretty, pert, and pleasant; the little rustic bridge that spans the Ourthe here is a capital snap, and for a few centimes the cow-herd will drive one of his sleepy beasts to the water-edge, and, hey presto! there you have a Constable ready painted. There are some charming views to be had at Beauseant, or along the Orthos Road. Toil up the Ciel Road (you can go by diligence an you wish), and strike out for Samree, a village perched on the heights, with richly-clad valleys on either side. You will be busy here.

Then there is the Chateau Diable, a fine walk, but a poor photograph; the "occupier" is not there, so one need fear little. It is a fine tramp to Beresmenil, though you will probably exhaust all your films ere you reach it. The Vallee des Tombes must be seen and "snapped," and, indeed, there is no boundary to the art possibilities of the place.

The route is Belgian Mail Packet, via Dover and Ostend. Leaving Charing Cross in the morning, La Roche is reached the same evening, or one can stop at Sy or Barvaux for the night.

There are worse places than La Roche for the photographer; I do doubt if there are better; you might try it.

ARCHITECTURAL WORK WITH A HAND CAMERA.

By S. E. Kelf.

There was a time when I went so far as to encumber myself with two cameras on an annual holiday, and drag round the country some thirty pounds' weight of apparatus under a summer sunlight sky. I have grown older, but the habit of using a camera at holiday-time was too strongly formed to go away without one. So for once I thought I would make a compromise, and dispense with the tripod. I felt I was doing a risky thing, as I intended grubbing about after buildings—and so it turned out. Some four dozen plates were exposed, hardly ever more than one on each subject, and they—the subjects (not the plates) were often miles apart.

Limiting myself to only six plates each day, I was very careful in using them. Still I found it was not altogether a successful experiment, simply on account of the absence of the tripod.

Buildings with tall chimneys, or even with no chimneys at all, had their tops partly cut off, and a windmill I walked a distance to secure has part of the sails missing. Most of the failures, moreover, were due to close or inconvenient quarters in obtaining the picture. The finder, brilliant as it may be, does not represent the view on the plate. For architectural work, then, either a finder that gives the exact size of the image should be used, or else do not, like me, be too lazy to take your tripod. Of course this advice does not apply to the really clever worker, who can make pictures without even a lens; but to the average man in the street.

METOL AND OTHER ORGANIC DEVELOPERS.

By C. H. Bothamley, F.I.C., F.C.S., F.R.P.S.

Metol, ortol, and similar organic developers, are not infrequently grey, instead of white, and then contain a small quantity of empyreumatic or tarry impurity, which is not easy to remove in the process of manufacture. When, in these circumstances, they are dissolved, the tarry matter remains in the liquid in a very fine state of subdivision, and imparts a brownish-yellowish or brown colour to the solution. If this tarry matter is not removed, it may cause stains or marks on the negatives, &c The best method of removal is to filter the liquid through a plug of cotton wool previously well wetted with water and supported in the apex of an ordinary funnel; it should be pressed down a little, so that the solution does not run through too rapidly. Filtration through paper is not so efficient for this purpose, and takes more time.

A singular myth has sprung up about metol. It is frequently insisted that when making up solutions of metol and sulphite the metol must be dissolved first and the sulphite added afterwards. If the reverse order is adopted, it is alleged that the metol will dissolve with great difficulty, or even not at all. I can only say that I often use metol, and that I always make up the solution by dissolving the sulphite first, and adding the metol afterwards. I have never had any difficulty in making the metol dissolve quickly without any heating.

◆

SOME PRACTICAL NOTES.

By Edmund J. Mills, D.Sc., F.R.S.

Photographic Surveying.—In photographic surveying, it is frequently expedient to work with long base lines, partly for the sake of saving photographs, and partly with reference to the scale of the plotting. Long base lines can rarely be measured unless tachymetrically; and for this purpose a telephoto-attachment to the usual rectilinear lens is probably the best resource at the disposal of the photographic surveyor. The "negative" or telephoto-attachment I employ is by Dallmeyer, and has a focus of five inches, the positive being a Goerz of 9½ inches focus. The entire combination is mounted in a long extension camera, working on an independent baseboard; scales and verniers are placed wherever necessary, so that every position can be very exactly recorded. The plates are isochromatic and of fine grain; and a yellow screen is indispensable.

A convenient amount of "magnification" having been decided upon, a straight piece of road (either level or of definite slope) is selected for determining the focal length corresponding to the pull. In a suitable position on this, a white staff of known height is set up, and fixed in a vertical position by two or three cords and skewers. From this, by a metric tape of known error, distances that may be technically called "long" are measured off, and the staff photographed at the position of optical centre. [A distance is photographically "long," when the lens is working at about its equivalent focal length.] With the ordinary camera back, one can easily arrange to photograph five positions on one plate. The plate having been developed for contrast, is dried, and the negative image measured with a good kathetometer; the mean of 10-20 such measurements is sufficiently accurate.

We have now to find the focal length F. If D be the tape distance measure to a point immediately below the camera screw, h the height of the image, and H the height of the signal,

$$F = \frac{hD}{H}$$

Inserting in this equation the experimental results, we obtain a value for F, which is somewhat too great. The reason for this is that the position of the front focal plane of the optical combination is beyond the front of the combination. In order to secure an accurate result, we must subtract the F thus found (less the distance of the ground glass behind the screw) from D, and recalculate F with the corrected D. The result is the actual focal length under the camera conditions. If the distance be "long," this will be practically identical with the equivalent focal length calculated from the well-known equation—

$$F = \frac{D}{n+1}$$

where n is the reduction of the staff, and D must be twice calculated as before. Having thus obtained satisfactory values of F, we are in a position to measure base lines of considerable length, by simply setting up a staff and photographing them, the camera arrangements being, of course, at "fixed focus," F.

I have found it a great improvement to have a scale of millimetres engraved on the barrel of my negative lens, and to make a little empirical table showing the alteration in focus corresponding to small movements of the barrel alone, for these sometimes have to be made.

Two determinations of F made during last summer, at value of D = 498.15 metres and 356.20 metres respectively, give F = .99227 metres and .99245 metres; the mean of these, = .99236 metres, may be taken as accurate to about 1 part in 10,000. The equivalent F was found to be .99209 metres.

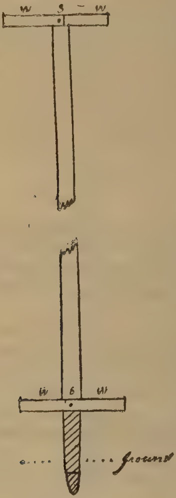
Work of this kind requires a quiet day, a quiet road, and a strong sun. The calculation may appear a little tedious, but is not really laborious; and when once done, will seldom require verification.

Long base lines are, of course, measured in this way from both ends, and the mean of the two determinations taken. For a base line recently fixed in this way, the two values of h only differed by .0043 mm.; the length was 661.884 metres (say, four-tenths of a mile).

As a further security for the accuracy of the base line, it is always well to measure some line in the foreground—such as a roof ridge, or width of a house, or the distance between two staffs. This foreground line, when plotted, should agree well with its known length. For still more minute accuracy (if required), one must have recourse to mathematical processes, such as are detailed for surveyors' use by Professor Merriman in his "Method of Least Squares."

A photographic arrangement such as that above described would be equivalent to a theodolite with about a six-foot circle. It would be impracticable to work with a graduated circle so large. Angles, consequently, have to be obtained by plotting. There can be no doubt that the tele-combination is a great additional power for the photographic surveyor. It has, of course, its drawbacks. The margins of the field are, I believe, a little uncertain; but any material amount of wind is fatal to the work, and strong light is almost a necessity. It is also much to be wished that a rapid isochromatic plate of fine grain could be had, so as to shorten the exposures. Still, the surveyor who takes with him a telephoto lens will undoubtedly have his reward.

The following is a sketch of a staff I have found very suitable to work with:



It consists of five pieces, jointed together on the fishing-rod principle; when all of these are used, a clear height of about 20 feet is obtained. The height is read between two pairs of expanded wings (*w w*), 18 inches in extreme span, and joined to the staff by a screw at s and butterfly nut. Steadying cords are attached to brass eyes screwed in the back of all the upper joints. The staff is painted white (with zinc white paint), and is square in section, the top joint being ¾ inches in the side. For packing, the staff is taken to pieces; the wings are turned vertically on to the stem, and fixed again there with the screw. If the wind is troublesome, the wings are fixed in a drooped position, or not expanded at all. The shaded portion is painted black.

Optical Centre.—The position of the optical centre of a picture on the ground glass has to be found for various purposes. Camera flanges are, as a rule, not accurately centred. In works on photographic measurement, elaborate methods are given for ascertaining this point. The following will be found very easy of application:—The ground glass is preferably graduated in square centimetres, and centrally up and across in millimetres. Everyone should have his ground glass graduated. Assuming the lens flange to have been fixed on, screw into it from the back a piece of well-fitting brass tubing a few inches long. Now shut down the ground glass, and rack the brass tubing against it; the graduation will at once show whether the lens centre is opposite the graduation centre or not. If not, move the rising and cross front until it is. Should the tubing be suspected of hanging too low on account of its weight, carry out the experiment with the camera looking downwards.

Line Transfers.—The difficulty of developing chromic printed line transfers, when ordinary gelatine paper is used, has led to various devices—such as prolonged soaking in cold water and use of weak alkalies. I have for some years employed liquid glue, *i.e.*, fully hydrated gelatine readily soluble in cold water—and soaked the usual transfer in a two per cent. solution of this, containing about 0.8 per cent. of potassic dichromate. If the printing is found too slow, a few drops of vanadate of ammonia solution are added to the fluid gelatine. The print is rolled over well with some thinned out Penrose's transfer ink, fanned free from turpentine, and soaked in cold water. In about a quarter of an hour the development process can be proceeded with.

Metallic objects of polished surface present a well-known photographic difficulty. Among the numerous suggestions for overcoming this I have not seen the following: Warm the article very slightly, and dust over it some finely powdered resin placed in a handkerchief. Give a slight tap to remove any coarse particles, and photographin can be proceeded with as usual.

THE WEAKNESS OF SQUARED PICTURES.

By J. Rees.

The rarity of the perfect negative is in no small measure due to the effort to extend perfection uniformly over a definite area $6\frac{1}{2}\times4\frac{3}{4}$, 10×8, and 12×10, or what not. It is rarely that so much photographic perfection as can be thus represented is found in nature. Neither does nature compose her pictures in so four cornered and straight sided a fashion. On the other hand, in practice, we cannot get away from the necessity of using a registering plate of some definite size and shape, and those in general use are probably as good as any The mistake made is in always trying to fill them. Whatever the subject upon the focussing screen may be, it is a cast iron rule that sharpness must exist over the whole of it before the head is withdrawn from under the dark cloth. In other words, mechanical perfection is the prime consideration. In the abstract we are prepared to admit that the artistic point of view is all important, and also that if there be one quality more marked about it than another, it is the airy one of not being bound down by mechanical rule and law. Yet in practice a certain square space is ruled out which in finding expression it must exactly fill. The artist, to whom as a specialist we should turn for guidance, does not work on these lines, but suits his canvas to the subject, and not the subject to the canvas. Even n every-day practice we do not buy the horse to fit the stable, nor the book to fit the shelf. The different methods of working of artist and photographer, it is true, will not admit of as close a following as we would wish. The one has the privilege and power of altering and selecting his material, the other has not. The focussing thumbscrew will not turn independently for the ancient church and the painfully modern lych gate leading into the churchyard, the Celtic cross and the homely tombstones around it, the picturesque fishing boat and the commonplace wharf it is moored at. But oftentimes the immaterial can be kept out—of the final print, if not the negative—to great advantage, if the effort at getting all on the plate sharp be regarded as a secondary matter.

The photographic rule should be to pick out the essentials of the picture, compose it as comfortably placed as possible in the plate, and ignore corners and sides. The result will not be a perfect negative in the ordinary acceptance, for it will have a fringe more or less deep of objects out of focus. But the highest function of a negative is surely to produce the best print, and by vignetting, this can be obtained from our new negative, although it may be only a half, two-thirds, three-quarters, or any other immaterial fractional part of the full size of the plate. Why not, it may be asked, get the whole negative as perfect as possible, trust to vignetting in printing to pick out the desired picture, and then kill two birds with one stone! Killing two birds with one stone, spite of the economical popularity of the proverb, is an extremely difficult thing to do. Much better make sure of one, and the better, bird. In this particular case the loss will lie in having to subordinate the best conditions for the expressing of the chief object that the less important may have a chance. For instance, the breadth and air given by a large stop and short exposure may have to be sacrificed to the smaller stop and lengthened exposure needful in giving sharpness to a comparatively unimportant object in a different plane. The inclusion of this latter also often cramps the important portion on the plate, and, beyond the discomfort of composing the chief object of interest in one corner, makes vignetting in the printing frame more difficult. It is like packing many differently shaped articles, necessary and unnecessary, in a box, taking care not to unduly crush any one. A more sensible plan would be to look the lot first carefully over, discard all but the indispensable, and give them fuller care and plenty of room.

To press the argument more closely home, it is well within the experience of most workers that very good pictures can be marked out from negatives that have not been subject to this selective process in their composing, and one that, from the orthodox point of view of equalised merit from corner to corner, cannot be regarded as successes. If the print of such a selected portion be carefully examined, possible improvements had the suggested method of treatment been adopted can be readily seen. The main impression it is desired to convey would be better expressed, not only in being more decisively presented, but also in disturbing detail being ensured. When the object to be kept out looms large in the foreground, it is a more difficult matter, if not sometimes admittedly an impossible one with an ordinary lens, but the selective power associated with the use of a telephoto lens may come in usefully under such circumstances in aiding artistic expression.

If a reader be not disposed at this unfavourable printing season to go to the trouble of testing from his own stock of negatives, he will find a full supply of examples in the photographic reproductions of the leading illustrated weeklies. They suffer sadly in strength by comparison with accompanying virile sketches, but the contrast is not anything like so marked if the petty square perfection of the corners and margins be covered with a paper mask. If the unmasked portion could be further strengthened, as we contend it can, by ignoring mere size and shape, the contrast would be still further reduced, and interest in the salient figure or action presented much heightened.

Pictures under these conditions are smaller, more scratchy, and do not lend themselves so readily to the application of the rules of geometrical critic of compositions. But they are far more suggestive, a quality high enough to outweigh the others. They may not, either, fit the existing spacing of the ordinary or orthodox mount and album. This is another gain in the long run, for it will lead to printing upon paper that will not need mounting, and upon which the sinking of the picture, if desired, could by a little mechanical ingenuity be readily devised and accomplished.

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HALOID TONING FOR LANTERN SLIDES.

By C. Welborne Piper.

Under this heading we may describe the production of toned lantern slides by the process of converting the metallic silver image of a developed and fixed slide into an image consisting of chloride, bromide, or iodide of silver. The process has decided advantages, in that it is easy and certain, and produces definite tones that are quite permanent if we take the simple precaution of exposing the slides to sunlight for a day or so.

The conversion of the image is accomplished very rapidly in one of the following solutions:—

Chlorising Solution.

Potassium bichromate	10 grs.	or	20 grms.
Hydrochloric acid	5–10 mins.	,,	10–20 c.c.
Water to	1 oz.	,,	1000 c.c.

Bromising Solution.

Potassium bichromate	10 grs.	or	20 grms.
Potassium bromide	5 ,,	,,	10 ,,
Nitric acid..........................	5–10 mins.	,,	10–20 c.c.
Water to	1 oz.	,,	1000 c.c.

Iodising Solution.

Potassium bichromate	10 grs.	or	20 grms.
Potassium iodide	5 ,,	,,	10 ,,
Nitric acid..........................	5–10 mins.	,,	10–20 c.c.
Water to	1 oz.	,,	1000 c.c.

Use only sufficient acid to render the solution active, avoiding an excess.

The bleaching process is completed in a couple of minutes, and the slide is then washed, soaked in a solution of potassium metabisulphate (strength immaterial) to remove the bichromate stain, washed again, dried, and then left exposed to sunlight until all apparent change of colour ceases. Exposure is sufficient when a bromide image has turned to a perfect grey without a trace of warmth when viewed by transmitted light. During this time a chloride image will change to a warm red-brown, but an iodide image will remain unaltered. Possibly with the latter, exposure is not really necessary.

We then have three definite tones, red-brown chloride, cool grey bromide, and yellow-brown iodide. The first is a better tone than that given by uranium, and the second is one that cannot be obtained by any other means; anyway, I know of no other process for obtaining a satisfactory grey, which at times is a very desirable tone.

It does not appear to be possible for any mishap to occur in the process, as the solutions work with certainty, and always produce the same results. Possibly the tone may vary with different brands of plates, but there does not appear to be any very appreciable difference.

It is easy to modify the tones within certain limits. A bromide image may be converted to an iodide image by simply bathing in a solution of potassium iodide, and a chloride image can be converted into a bromide or iodide image by using a bath of either potassium bromide or iodide. But we cannot by similar means convert the iodide image into either bromide or chloride, nor the bromide image into a chloride one. These conversion processes are just as easy as the original bleaching process, and there is only one point worthy of comment. The conversion of a chloride image into a bromide one does not, even with a ten per cent. bromide solution, appear to be quite complete; the result almost invariably has a trace of warmth. If a pure grey is required, it must be obtained directly, but the warm grey produced by the double operation is a very pleasing tone.

Since I first drew attention to this method of toning lantern slides, several workers have experimented with it, and have expressed great satisfaction with the results. This fact may perhaps induce others to take it up. A process that is easy, certain, and permanent is well worth attention.

◆

ABOUT "VIEWS."

By Allan Blair.

The honour of being represented in the Almanac along with that galaxy of talent that graces its pages makes the task of selecting a subject an exceedingly difficult one. The writer, who is as the least of the prophets, must needs be careful that he does not stray into deep waters and wreck his little reputation, and disgrace the Almanac. Let me therefore briefly touch a self-evident need, and I look at the subject from the point of view of a country photographer.

The "view" trade has now assumed vast proportions. There are firms doing an immense business in that trade alone, and supplying country photographers with millions of prints all of the "usual thing" type. The photographer might well enough keep this trade in his own hands, and make more money of it, too, by making these prints in the "off" season, but it is not of that aspect of the question that I would speak.

The "ordinary" view print has now become so common that it is merely purchased as an aid to the memory of the visitor, in describing to those at home the holiday that has been spent. Why should we not aim at something better than that? There are few towns but what have many really pictorial scenes around them that should pay the photographer to transfer to paper. These pictorially treated should be printed in platinotype or carbon and tastefully mounted, when they should sell at a price very many times better than the stock views. But they must be good; "ordinary" work will not do for this; you are working to secure as customers those who are artistically minded, and the ordinary view that they can purchase in the stationer's will not do for that class of customer—they want something better It is not necessary that the print should be of the ordinary stereotyped shape; in fact, it would be better that it should not be of that shape; to my mind the customary shape is not the best that can be chosen, it always seems too square. Let the work be unconventional, but do not imagine that by putting your photograph out of focus you thereby make it pictorial. In certain circumstances an out-of-focus effect may be slightly advantageous, but the "picture" must be there, out of focus or no.

The idea is, I think, worth consideration, and it will cost little to give it a fair trial. Do not try how cheap you can do the work make the price such that you will have a good profit for your labours, bearing in mind the old adage, "The more cost, the more honour."

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AN OLD FRIEND WITH A NEW FACE.

By A. L. Henderson.

About 30 years ago, more or less, some of your readers may remember what were called "magic photographs." They were ordinary silver prints bleached with hydrarg-perchlor, then washed. Tomake the image visible, all that had to be done was to moisten a piece of bibulous paper that contained an alkali. Put it in contact with the photograph (apparently plain paper), when up came the image. Later on some one published that if an under-exposed negative was treated before fixing, it would bring up more tones, but this method necessitated that the negative should be printed without fixing. I have treated many negatives in this way successfully. At first glance it would look as if the resulting negative might darken in the shadows, and in a short time become useless. Such is not the case; the negative would not blacken in the light. Some little time since I had a gelatine plate somewhat under-exposed, and thought of my old friend, bichloride. I applied it. The image rapidly bleached. I then well washed it; took it out to sunlight, and on the application of a weak solution of ammonia the image reappeared very strongly, and without the least trace of fog in the shadows. Readers, see the "new face." This was an unfixed plate, not unlike the magic photographs. I quite imagine I hear the question asked, What is their use? Well, ye illogical friends, enemies, and plagiarists hurry up, there is something in it, and I hereby give you my word I will not oppose the sealing of a patent. "First come must be the first served."

ON A POSSIBLE METHOD OF INCREASING THE WORKING SENSITIVENESS OF DRY PLATES.

By Howard Farmer (Photographic School, Polytechnic Institution).

A young student here, Joseph Jacklett, was one very dull afternoon engaged in copying a photograph, and showed me as a result a fogged positive exactly similar in appearance to the well-known badly over-exposed plate. On questioning him as to his mode of procedure, it appeared that, instead of being over-exposed, the plate had been badly under-exposed. Ilford Empress were used. This unusual feature indicated that the defective result was worth investigation, and this has shown that plates which have only received a fraction of the exposure required for a negative can be developed into positives The method consists in exposing the bare plate after the exposure in the camera and full development, to a light in the dark room sufficient to give full density. The plate is then again developed, fixed, and washed in the usual manner. The explanation seems to be that the ghostly image which is obtained on a badly under-exposed plate, while not sufficient to stand the fixing bath, is sufficient to act as a negative when the unfixed plate is exposed to light in the dark room. I am sending this brief account to the Almanac in the hope that, by others trying the method, the degree of practical utility of Mr. Jacklett's experiment may be ascertained.

* * *

SELKE'S PHOTOSCULPTURE.

By Henry O. Klein.

The exhibit of the above-named process at the Royal Photographic Society recently has created a demand for fuller explanations than those afforded by the official catalogue, which refers to the "agency of light," and gives rise to the belief that the process is identical with Pietzner's Photoplastic, of which process specimens were exhibited at the Paris Exhibition, 1900. Pietzner's method is based upon the swelling of bichromated gelatine, whilst Selke's Photosculpture has nothing in common with the former.

The principal features of Selke's process are the following:—The model is placed upon a platform, turning its profile towards a cinematograph. The lighting of the subject is done by means of powerful electric light, which is filtered through blue glass, thus producing a monochromatic illumination. It is essential that "colour" becomes a matter of least importance, and that no unactinic light reflected from the subject may interfere with the shadow outlines, which are due to form exclusively.

Between the light and the model a tightly-stretched girdle is placed, which throws a sharply defined shadow, and outlines with highest precision the "forms" of the head.

Whenever the cinematograph begins to work the girdle also slowly advances, and, altering its position towards the model, causes at first the most distant parts of the features to gradually disappear, as, for instance, the nose, the eyes, the chin, until after 40 to 50 exposures, and different complementary positions of the shadow-producing girdle, nothing remains but the nearest part of the ear. The whole series of exposures is taken in three to five seconds, and comprises a complete shadow record of every part of the head. The positive copies of the films are enlarged to life size, pasted on thin cardboard, and eventually cut out with extremely fine fret saws.

As all the fifty different cuts complement each other, they are pasted together in their respective order, and the joints made to disappear with the help of "plastilina." A fairly good plastic representation will be the result, which already shows a remarkable likeness.

Of this cardboard model a mould is made in plaster of Paris, and of this the subsequent casts in ivory imitation, metal, terra-cotta, &c.

That the work of the sculptor cannot entirely be dispensed with is obvious, but his chief aims will lie in the production of a suitable decorative border design, to increase the artistic effect of the relief; further, to correct little deficiencies in the original mould, to soften unimportant and to emphasise characteristic details of the features.

To recapitulate Pietzner's method for the sake of comparison, I may mention that of an ordinary negative a gelatine relief is produced by the action of light upon bichromated agar-agar, which is a gelatine made of the seaweed of Japan, and which possesses the excellent quality of swelling in exact proportion to the action of the light, therefore rendering this material more suitable for photoplastic work than ordinary gelatine, which does not reproduce the tender gradations of the negative.

By Pietzner's method beautiful photoplastic representations of works of art may be obtained, and I refer readers interested in this subject to Hofrath Volkmer's article "About Photoplastic" in Penrose's Process Year Book of 1900. This will afford more detailed information.

Finally, reviewing the history of "Photosculpture," it may be of interest to note that Pötschke, in 1891, produced plastographic works based upon the same principle as Selke's. But in those days the cinematograph was not at hand, and no living model could endure the great length of a series of 40 to 50 exposures.

Selke's Photosculpture is a triumph of applied photography, and the rapid strides of this comparatively young invention in the various branches of art, science, and industry are truly amazing. We cannot be surprised if the editor of one of our leading daily papers opens his dissertation on Selke's plastographic works with the words: "Photography in the service of the plastic arts—what next?"

ALBUMENISED PAPER VERSUS P.O.P.

By G. T. Harris, F.R.P.S.

Albumen prints in the present day are almost as little known among latter-day photographers as are collodion negatives. On all sides gelatino chloride is the mainstay of the photographer, and except in large-view publishing houses albumen paper has, to all intents and purposes, vanished from the printing room. The general impression is that gelatino-chloride paper gives much superior results, apart from the highly glazed surface which is looked upon with so much favour. Looking recently through a stock consisting of some thousands of landscape views printed on albumenised paper, their extreme regularity and beauty suggested to me a comparison between the two processes, and this more especially as I had recently been reviewing a fairly large batch on gelatino-chloride, also landscape subjects.

Setting aside the question of glaze as not in any way influencing the printed image per se, the conclusion I came to was that the time-honoured albumen print, in quality of gradation and richness of colour, more than held its own when compared with its rival, gelatino-chloride. The question of "glaze" is entirely one of individual taste. Personally I consider that a carefully printed and toned albumen print, hot pressed, has a refinement of appearance utterly lacking in the metricious glaze of the gelatino-chloride. Several conditions are essential to obtain the ideal print on albumen paper, the most paramount being a suitable negative; and I think that inability on the part of the photographer to realise this factor has done more to overthrow the popularity of albumen printing than any other cause, and conversely to establish that of the chloride print. The albumen print at its best absolutely demands for its production a negative of the highest quality: the exposure must be accurate within very narrow limits, and the density much greater than is usual with the negatives nowadays produced. The deepest shadows in the picture should be represented in the negative by fairly clear glass, in order that the maximum amount of deposit may be obtained in the albumen print; where the shadows of the negatives are veiled to any extent richness in the resulting print is quite unobtainable. Over-exposed negatives, and negatives lacking in density can never be successfully printed in albumen, and this is probably the fact why albumenised paper has been so largely supplanted by gelatino chloride. Passable prints may be obtained on chloride from negatives that would certainly be decisively rejected where albumen was concerned. Gelatino chloride papers so easily give fair-looking results from negatives of all degrees of mediocrity that the photographer is largely relieved from the responsibility of striving for high-class negatives.

Of late years albumen papers have been obtainable having surfaces very highly glazed, several of which have passed through my hands, and have been very carefully tested. It is almost impossible to distinguish the prints visually from gelatino-chloride prints, provided the negatives have been reasonably high-class, and the paper used within a short time of its preparation (for papers of this class seem deficient in keeping powers when compared with the albumen papers of ordinary surface).

Of course, the advantages of gelatino-chloride, from the average photographer's point of view, are so obvious that it seems an idle mission to uphold the claims of albumen; but a strong feeling is always with me thta albumen printing hs afallen into desuetude through the fault inherent in itself. Compared with its rival, the manipulations are very much more reliable and less capricious. Toning is certain with albumenised paper when the bath is carefully kept, whereas with chloride, eccentricities of all kinds seem liable to make their appearance without the least provocation. Albumen, from the manipulator's point of view, is certainly a far more reliable vehicle than gelatine, and is less liable to injury in the various operations. In large batches albumen is incomparably easier to work, and thorough elimination of the hyposulphite more readily obtained. The preparation of the sensitive paper being taken out of the hands of the photographer is also a probable reason for the preference shown for gelatino-chloride, as it relieves one of the trouble of preparing one's own material.

All things considered, albumen is capable of doing all that gelatino-chloride does, even to giving the high surface, if this be necessary; and when it comes to a question of permanence, I fancy that albumen beats easily. It would seem advantageous to the professional photographer to consider the revival of albumenised paper, printing in a manner that will imitate the gelatino-chloride so largely in use, as in so doing he would save very considerably by the home preparation of his paper. The quality of work would, I feel sure, be in no way depreciated by a return to albumenised paper, provided that the photographer understood the preparation of his sensitive paper, and paid careful attention to his toning baths. Indeed, when one critically regards the gelatino-chloride print of to-day as issued from the average studio, it is difficult to imagine anything that answers less to the conception of a thoroughly good print. Bad colour and double toning are the order of the day, and only its high glaze secures the public appreciation for the chloride print.

TELE-PHOTOGRAPHY.

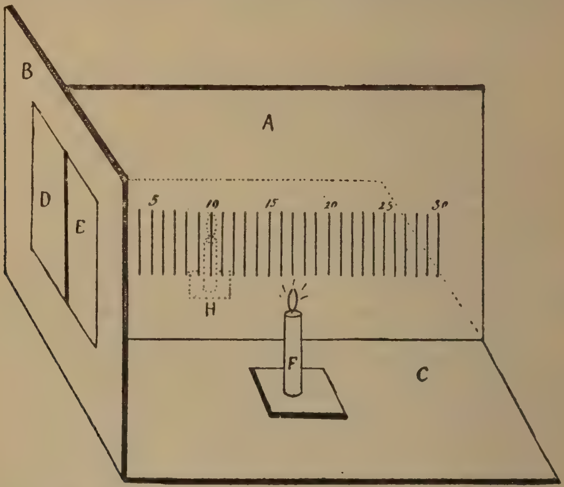
By William Brooks.

I myself, like many others, was under the impression that tele photography was not much more than a photographic curiosity, and might be useful for military purposes, until I had placed in my hands, at the late exhibition of the Royal Cornwall Polytechnic Society, an up-to-date apparatus by Mr. T. R. Dallmeyer for a practical test. After overhauling the apparatus and making myself master of the working details, I made trials of different subjects at various distances from one mile to three miles, with perfect success, and was astonished at the results I obtained. In the first place the apparatus must be mounted on a very rigid tripod, as the slightest vibration is fatal to a perfect result. Then, again, the focussing must be very carefully done; to focus with an open lens is almost out of the question. For focussing, I was obliged to stop down to about *f*-11, and distributed the focus as evently as possible. That done, I stopped down until I got the effect required, the exposure had to be nicely timed, and the development done slowly and carefully, allowing plenty of time to get as much gradation as possible; rushing the image out as some are very fond of doing would be fatal to a perfect result. I found it was impossible to tell the difference from a picture taken in the ordinary way I had to make quick exposures, my subjects being marine. The part that brought the utility of tele-photography to my mind was, the distances were not dwarfed the same as we are accustomed to see them rendered in the ordinary way; for instance, one of my subjects had a boat with the sails up which formed the foreground of my picture, which was about three-quarters of a mile distant. A quarter of a mile beyond the vessel was a row of houses on the distant quay. These houses were not dwarfed, but the size of them was in keeping, and had a very natural effect. We often blame artists for not being truthful in their rendering subjects as to size. After making a very careful examination I estimated that the distant houses were about four times the size they would have been if taken in the ordinary way; for instance, if I had gone near enough to take the boat the same size with lens without the tele-photo attachment, the distant houses would have been about four times smaller, and it is in a case like this the tele-photo apparatus steps in and gives a far more truthful rendering. I consider it a mighty power placed in the hands of the photographer that ought not to be overlooked.

AN APPARATUS FOR DETERMINING THE DENSITY OF NEGATIVES.

By C. W. Babbage, Wanganui, New Zealand.

In printing on bromide paper, or any other development paper, the instructions usually state, to get the correct exposure, you must make trial tests; this necessitates a waste of material and time. As the factors, speed of paper, and actinic power of light can be measured, if we can measure the density of the negative to be copied, the exact exposure can be estimated. The following apparatus has been devised to obtain this information: It consists of three boards, A B C in the sketch. A is nailed at right angles along the centre of C, and B has a hole D E cut out of its centre. The board is nailed across the ends of



A and C, so that the board A comes in the centre of the opening D E. Over this opening I paste a piece of plain white paper to evenly diffuse the light of two candles, F and H, on each side of A. I then take a photographic plate, expose it momentarily to the candle, and develop to a thin density, and fix it in the half D. On A I mark a number of inches. To use the apparatus I place the negative I wish to test in front of the opening E, and place the candle H opposite the mark 10 inches. I then move the candle F until the negative at E appears the same shade of light as D. A simple rule of three sum gives me the density of the negative as compared with my standard in D. For example, I found by experiment my test piece of negative D requires 30 seconds' exposure to a candle at six inches to get a properly-exposed print on bromide. I therefore multiply 30 by the square of the distance of H = 10^2, and divide by the square of the distance of F from its negative, which, we will suppose, was 17 in., and we get

$$\frac{30 \times 10^2}{17^2} = \frac{3{\cdot}000}{289} = 10$$

Therefore, the exposure necessary for this negative will be 10 seconds. I have tested the apparatus in the extreme cases of one so thin that five seconds was sufficient to print it, while another negative was so dense as to require an exposure of 900 seconds, and both were a success.

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A CAMERA GAME.

By JAMES REUEL SMITH, New York, U.S.A.

AGREEABLY with long custom, Colonel Thimis had invited a number of friends to spend some of the summer weeks of 1899 at his country seat in Rechawanes.

Among the guests there was only one camerist, and during the first few days his successful pictures of the company in unconventional surroundings caused much pleasant diversion, and kept him fully occupied.

He was really a charming fellow, but the trail of tradition stretched over his path, and worked its effect in early course, for no one can otherwise account for it or explain why it is that even the dullest of audiences at a charade party will spontaneously pronounce the word "photographer" the moment some one steps forward with a black cloth and the legend, "Now, look pleasant, please."

Not one in a million ever heard a Daguerrean disciple of the present day use this phrase, and yet it would almost seem to be a general hallucination that it is a basic formula of the profession.

Thus the camerist was soon very frequently engaged in solitary occupations; after the first feelings of inquisitiveness were satisfied, the mystic operations in the dark-room, and even the wonders performed in sunlight with bits of white paper and pieces of smoky-looking glass had no witness but himself; the company seemed to feel that there was nothing very sociable about the atmosphere of a camera, even if it was not pervaded with gloom that required an admonition to look less lugubrious, and they silently quitted its manipulator for the links, the lake, the tennis courts, or the country paths and drives.

When, however, after a three days' rain, billiards and cards, dominoes and other round games had become played out, and the grounds and roads were still too soggy for outdoor sports, the camerist came to the rescue with a new and welcome amusement which no one had expected from his apparatus.

A white string was tied around the pendulum of the large hall clock, which stood in a sunlit nook, and a scaled rule was placed in front of the string. A roll film camera was focussed upon the scale; every one drew a number from a lotto bag, and the game began; the object being to snap-shoot the string at the central point of its oscillation behind the scale.

An entrance fee was agreed upon for each shot, the number of shots being unlimited.

A suitable mask before the film-holder greatly increased the exposure capacity of the instrument, and each player photographed his own number each time he shot.

The interest in this novel amusement lasted during several hot afternoons, excitement running high during the exposures, surmise and expectation being tantalising in the interim, and rivalry being keenly stimulated after development.

In addition to the various "pots," the host afterward forwarded a fine camera to each of the two most enthusiastic players, and of that summer's party, which numbered more than a score, four have since added photography to their other accomplishments, while all agreed that the camera can furnish a game full of liveliness and sociability at a moment's notice.

TIPS FOR TYROS.

By E. J. Steer, Capetown.

The Dark Cloth in the Field.—It will be found a great convenience when working in windy weather to have a few "hooks and eyes" sewn at the corners and round the edges of the dark cloth, as the cloth can then be readily kept from blowing off the camera by hooking the edges together under the camera.

Light in the Dark Room.—A safe, inexpensive and most effective dark room lamp may be made by cutting three sides of the front of a 14lb. biscuit tin, turn up the flap to form an eye shade, and paste over the opening one thickness of cherry fabric and two of orange tissue paper. Give the paper a good coat of castor oil to make it more translucent. A candle stood on the table covered by this "lamp" gives ample and safe illumination. The sides of the tin should be perforated for ventilation, and a strip of bent cardboard or tin fixed along the sides above the perforations. Holes should also be made in the top of the tin, covered by a bent piece of tin soldered on. I have used this form of "lamp" for some years, and have never had a case of fog, while the light is sufficient to enable one to read small print.

Concentrated Hypo.—I always keep my stock of hypo in solution containing one part of the salt in 1½ parts of solution, and make this by suspending 4 lb. of hypo in a muslin bag in 48 ounces of water in a wide mouthed jar. Solution is soon effected, and by making the total bulk up to 96 ounces with water, the strength is as above. This concentrated solution will keep almost indefinitely, and is most convenient for use.

Pyro.—If concentrated solution made by the usual nitric acid formula be kept in a well-stoppered bottle covered with black paper, it will be found to retain its strength and colour for a long time.

Ammonia.—If the strong solution of ammonia (880) be diluted with an equal bulk of distilled water as soon as it is purchased, it will retain its strength much longer than if undiluted.

Ferrous Sulphate Solution.—The solution of sulphate of iron used in making the ferrous oxalate developer may be kept in good condition indefinitely if the freshly made filtered solution be put into one ounce bottles full up to the cork, and well corked.

Sodium Hydrate.—It is almost impossible to weigh small quantities of this salt, as it is so deliquescent. The best way is to dissolve an ounce of the hydrate in sufficient distilled water to make four ounces of solution. It can then be readily and accurately measured off, the strength being one of salt in four.

Carbon Tissue.—I find the best method of drying the sensitised tissue is to squeegee it on to ferrotype plates, dry off the back with blotting paper, and set up on end in a moderately warm room in a current of air. The tissue dries quite flat, and free from dust, which was not the case with the old method of drying face up on curved blotting boards. Carbon printing is rapidly growing in favour in South Africa, in spite of the difficulty of working in a hot climate.

Silver Printing on Rough Papers.—The best method of preventing the "sunk-in" appearance so often seen in this class of print is to dry the paper after floating on the sensitising bath before a fire, as the more rapidly it is dried the finer the resulting print.

UTILISATION OF WASTE GLASS.

By J. Tilfor.

Having frequently seen inquiries in the British Journal as to how waste glass may be utilised, I would suggest its employment for lantern slides, or other transparencies, by contact printing on dry collodion.

The glass, having been made chemically clean, is first coated with a substratum of either albumen or gelatine. I prefer the latter. A soft gelatine—two grains to the ounce—is dissolved in distilled water and filtered through paper while hot, a few drops of ammonia being afterwards added. The plate, placed on a pneumatic holder, is dusted, rubbed over lightly with a piece of clean sponge, dipped in the gelatine, and a portion of the solution poured on and drained from each corner. The plate can then be set up on blotting-paper, in a place free from dust, to dry spontaneously. The coating with collodion and sensitising is done as for wet collodion. The silver bath should be slightly acid, and the collodion not newly iodised. After sensitising, the plate is washed under the tap, rinsed with distilled water, and a preservative poured on and drained off from each corner. It is then set up in the dark room to dry. No drying-box is necessary. Many substances can be used for the preservative—albumen, beer, coffee, gelatine, tannin,

&c. Albumen I consider one of the best. The white of an egg is well shaken up with six to eight times its bulk of distilled water and half a drachm of ammonia, and, when the froth has subsided, filtered through paper.

These plates will keep for a considerable time. Before the advent of gelatine plates I used them for many years for negative work in the field, and have kept them for several months.

A few seconds exposure to bright daylight is sufficient for contact printing.

Developer.—Pyro, 2 grains; citric acid, 1 grain; distilled water, 1 ounce. Before developing, the plate should be wetted with distilled water. Sufficient of the developer to cover the plate is then poured on, holding the plate in the hand or on a holder, returned to the measure, and a few drops of a 30-grain solution of silver nitrate added, again poured on, and kept moving till the picture is developed, occasionally draining off, so as to judge of the density. After washing under the tap for a few minutes the plate is fixed in the usual hypo bath. The fixing is rapid, as also is the after-washing, a few minutes under the tap being sufficient.

Should a slight opalescence appear after drying on those parts that should be clear glass, varnishing will restore the transparency.

THE HISTORY OF GELATINO-CHLORIDE P.O.P.

By Joseph Barker.

It is curious to note the extraordinary misstatements made by some persons who profess to write the history of gelatino-chloride P.O.P.

There is a tendency amongst many writers of photographic history to exhibit a select few at the expense of the real worker, which is not only wrong, but is a serious drawback to progress. Many instances could be given where persons have studied and perfected a subject, and, after giving the benefit of their labour free to all, have found, by way of thanks, that they are wholly ignored, and the credit of their labour is given to some one else, the result being that many workers now keep their facts and discoveries to themselves.

Now, as The British Journal Photographic Almanac is *the* authority on matters photographic, it seems desirable in the interests of photographic truth that the following brief statement of actual facts should be placed upon record in its pages, leaving a fuller account, which would include the history of gelatino-chloride for another time.

1. The first working formula for the use of bromido-chloride of silver in gelatine was given in an article by myself in The British Journal of Photography for June 18, 1880.

2. The first gelatino-chloride P.O.P. prints exhibited in public were shown by myself at the London and Provincial Photographic Association, in February, 1885, full particulars of the process being given in an article by myself in the issue of The British Journal of Photography for March 6, 1885.

3. The first person to introduce this paper upon the market com-

mercially was Mr. Satchfield, and his first advertisement appeared in THE BRITISH JOURNAL OF PHOTOGRAPHY for March 20, 1885. This was followed by others from time to time, but it was not until the Ilford Company took the matter in hand and produced their P.O.P., in October, 1891, that commercial success may be said to have been achieved, and here it may be stated that I have a piece of this first batch they issued still in my possession, and that it is in very fair condition. It has acquired a light brown tint, which, however, is nearly all removed in the hypo bath, and it prints and tones well.

I may add that the prints shown by myself in February, 1885, when introducing the process, are in an excellent state of preservation, without the least symptom of deterioration.

CYCLO PHOTOGRAPHY.

By R. J. BAILEY.

VERY few improvements have been made during the past year in the photographic apparatus designed specially for the use of cyclists, the only important one being the greater choice of films. Plates are too heavy for the cyclist who wishes to enjoy his riding, and films must be considered as the only satisfactory medium for carrying the sensitised emulsion. One of the greatest difficulties to the cyclist photographer is the conveyance of his camera and other articles necessary for the complete enjoyment of both hobbies.

After experimenting with all forms, I am still more firmly convinced that the method I advocated in the last year's ALMANAC—viz., over the back wheel—is the best and most convenient.

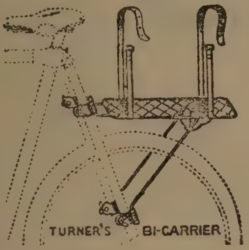


Fig. 1.

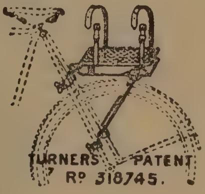


Fig. 2.

With the general adoption of "free-wheel" bicycles, it is very essential that there should be no interference with the steering mechanism. Further, luggage of any kind placed on the front of the machine increases the amount of work to be done against a head wind, and the liability of side slipping. There is little doubt that the most reliable form of carrier is that made by Mr. H. G. Turner, of Manchester, known as the bi-carrier.

Its weight is only 1 lb., and it will carry a load of 25 lbs., thus leaving a very considerable margin for all forms of photographic apparatus now carried. It is easily and quickly attached and detached, the screws being fitted with butterfly nuts. The clips used to fasten the carrier to the machine are lined with leather, so that the enamel is not injured. It may be obtained in varying sizes from 10 inches by 3 inches up to 19 inches by 8 inches. Being very strongly made, one need never fear the possibility of collapse. A special form has been constructed for the carriage of photographic apparatus, which is provided with spiral springs that absorb the vibration, thus preventing injury to the articles carried. This form can be used just as conveniently for ordinary luggage, and is the one recommended for photographers.

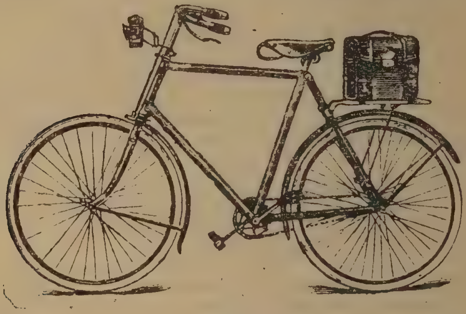


Fig. 3.

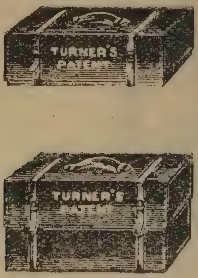


Fig. 4.

In fig. 1 the ordinary carrier is illustrated; fig. 2 shows the spring camera carrier, and fig. 3 represents the camera fastened to the machine.

Another useful article for the photographic tourist is the telescopic valise, into which the camera case can be placed, thus affording additional precaution against dust and preventing the possibility of rain injuring the articles carried.

The accompanying illustrations (fig. 4) are almost sufficient description. The lower part is fitted with straps for fastening to the carrier, and on account of the extension possible will hold any photographic outfit likely to be carried by a cyclist. The top of the valise being flat, a tripod, or other articles, may be strapped outside.

A PHOTOGRAPHIC STUDY OF THE BARK OF TREES.

By J. H. Baldock, F.C.S.

In response to a call by our esteemed Editor, I beg to submit a few remarks on the above subject, which, I hope, may not be quite devoid of interest. My first idea was to entitle the article, "How to tell a tree by its bark?" but this seemed such a "tall order" that I modified the title as above. Although, perhaps, it would be possible from a

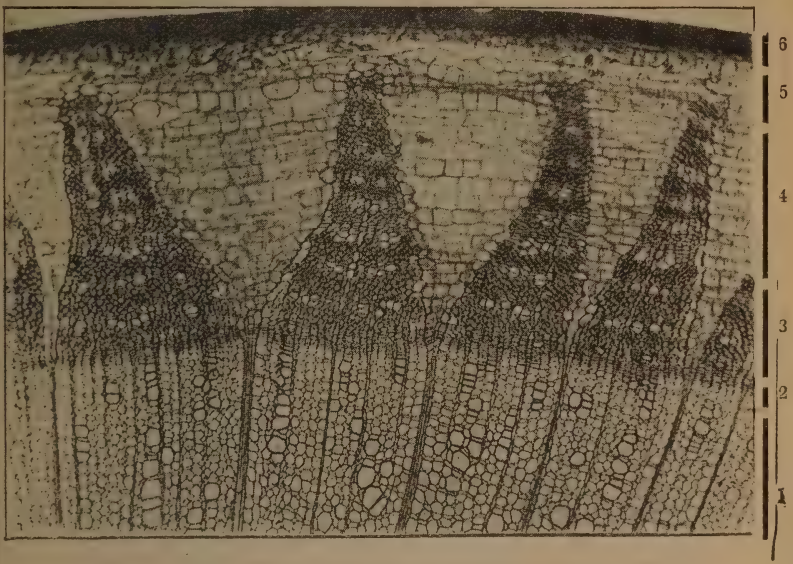


Fig. 1.—Transverse Section of Lime-tree Bark, &c.

1. Wood. 2. Cambium. 3. Bast. 4. Dilated outer end of Primary Medullary Ray 5. Primary cortex. 6. Cork.

botanical point of view to tell any tree by its bark, as easily as it is done by its leaves, flowers, or fruits, especially if the subject was studied with that object in view, yet, photographically, it would not be so easy.

Let us, then, consider what is the bark of a tree, and why the external appearance of the bark of any one tree differs from that of another. With this object in view, I propose, in order to give some sort of finality to the subject, to take only the bark of exogenous or dicotyledonous trees, with which, in this country, at least, we are the best acquainted, although, of course, in tropical countries the gigantic tree palms and ferns, the endogenous or monocotyledonous, and the acrogenous or acotyledonous stems would equally exhibit striking differences.

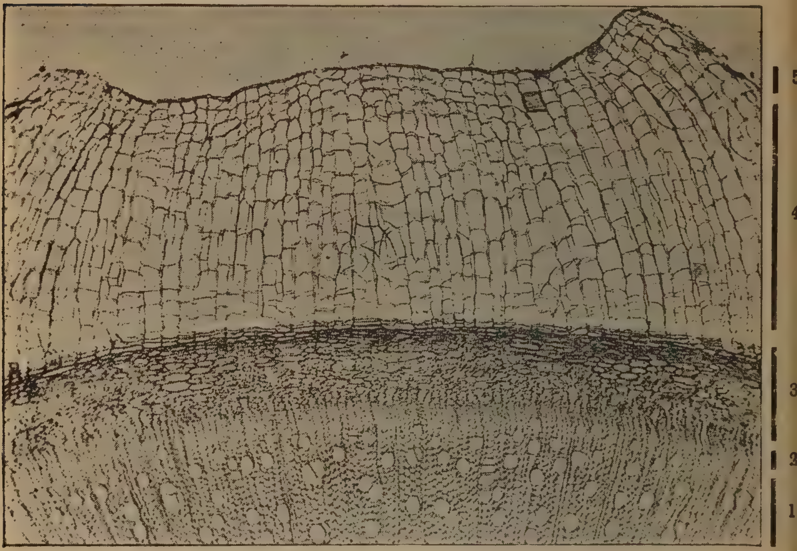


Fig. 2.—Transverse Section of Maple-tree Bark, &c.

1. Wood. 2. Cambium. 3. Bast. 4. Cork. 5. Periderm.

Taking, then, our dicotyledonous stem, we may divide it into two parts, *i.e.*, the xylem or wood, and the phloem or bark. A transverse section of such a stem shows the parts admirably. In the centre is the pith, then comes the wood, which is traversed by the medullary rays, and these end in what is called the cambium, which consists of vitally active cells, and produces on its inside new wood, and its outside fresh layers of bark, itself constantly increasing in diameter. It is to the structures outside this cambium layer to which this communication refers, *i.e.*, the bark.

Any number of photographs might be shown to illustrate these various tissues, and, thanks to the Editor, I am able to show three striking examples of bark structure, with its connection to the medullary rays, cambium or xylem. These are photo-micrographs, and the magnification is about + 50; fig. 1 is a transverse section of the lime tree (Tilia Europæa), and a very characteristic one it is. Taking the various structures in the order shown, and the order is the same in all three photographs, we commence with the wood (1). Then comes the cambium (2), already referred to as producing new wood on its inside and new bark on its outside, followed by the bast (3), and the dilated ends of the primary medullary rays (4). Lastly, we get the primary cortex (5), and the suberous or corky layer (6). In this particular section, three things are specially noticeable, *i.e.*, the dilation of the medullary rays (4), the development of the bast (3), and rosette crystals of calcium oxalate in the cortex (5).

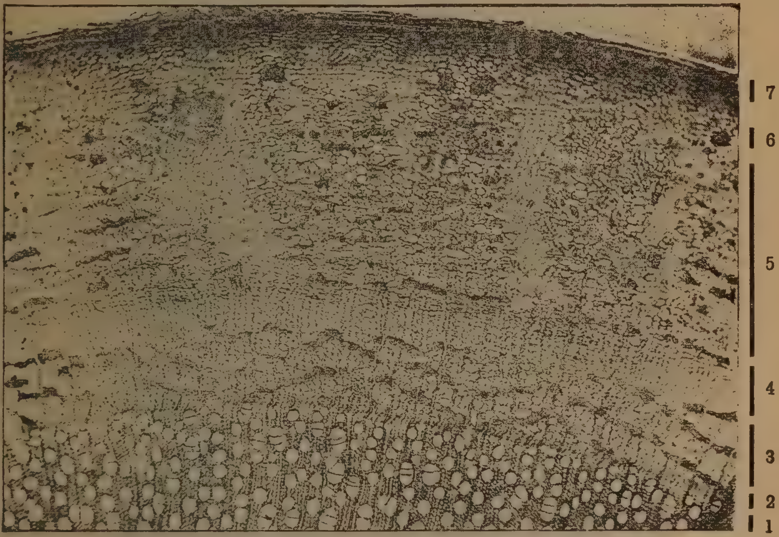


Fig. 3.—Transverse Section of Willow-tree Bark, &c.

1. Wood. 2. Cambium. 3. Thick-walled bast fibres. 4. Bast parenchyma. 5. Secondary bast. 6. Rosette crystal (calcium oxalate) 7. Cork.

The bast in this bark is very much developed, and is used to make mats, known as Russian, bast or bass mats, and is also employed by gardeners for tying up plants. Another tree having a similar development, *i.e.*, the Paritium elatum, furnishes Cuba bast, employed for tying up bundles of Havana cigars, and also by gardeners, while the bast of the lace bark tree (Lagetta lintearia) of Jamaica is well known to most persons.

In fig. 2, which is a transverse section of the maple tree (Acer campestris), we see a widely different structure. Taking as before the wood (1), the cambium (2), the bast (3), we come next to a very great development of the suberous or corky layer (4), strikingly different from that seen in fig. 1, and also from what will be noticed in fig. 3, the periderm (5) being in this case the outer layer of all. Crystals are also

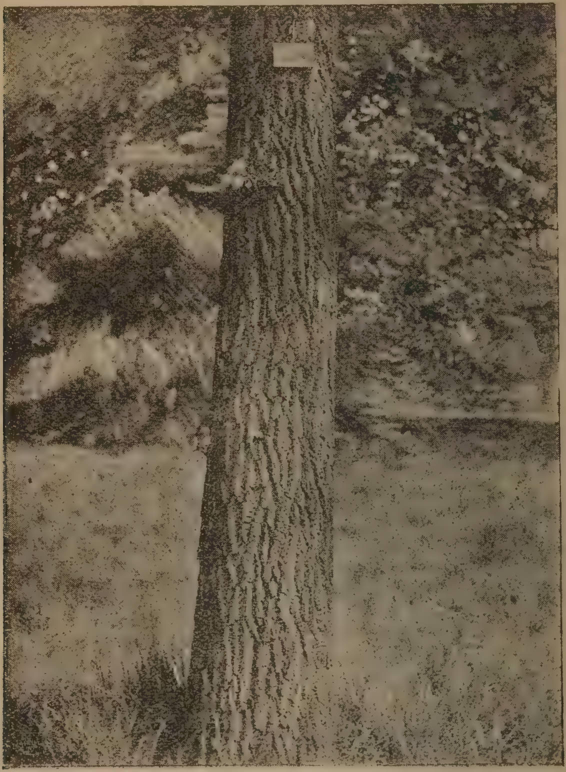


Fig. 4.—Black Poplar.

THE HIGH JUMP.

Taken on Mawson's Electric Plate, by Mr. J. W. Burrows.

Negative by His Grace the Duke of Newcastle, on a "Mawson" plate.

found in this bark at the upper part of 3. Although the photograph in this instance does not show them very distinctly, they are, however, easily seen in a section when examined under a microscope.

In fig. 3, which is a transverse section of the willow tree (Salix alba), we have again a structure differing entirely from either of the two previously referred to. The wood (1) again coming first, followed by the cambium (2), we then find three interesting tissues, viz., thick-celled bast fibres (3), bast parenchyma (4), and secondary bast (5), which give quite a characteristic appearance to this bark. Then, again, rosette crystals are seen at 6, while the suberous or corky layer is observed at 7.

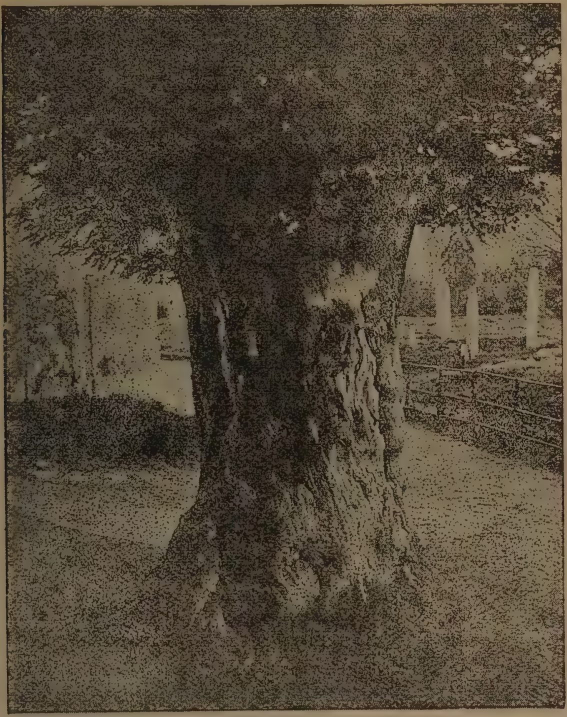


Fig. 5.—Yew in Stone Churchyard.

I have selected these three illustrations of bark very much at random, out of a large number in my possession, not perhaps because they are more characteristic than others, because in reality no two are at all alike, but they will reproduce well, and so serve to illustrate the subject matter of this communication.

With regard to the crystals found in barks, these are very common, and generally consist of calcium oxalate though sometimes calcium carbonate occurs, in some cases hanging from a cell wall like a bunch of grapes, forming a cystolith. The inner layers of bark generally have single crystals; the outer layers, clusters or rosettes. This calcium oxalate presents itself in various forms, such as square, diamond shape, oblong with pointed ends (like a school boy's cat), and in rosettes. It seems to be formed by the absorption of calcium sulphate,

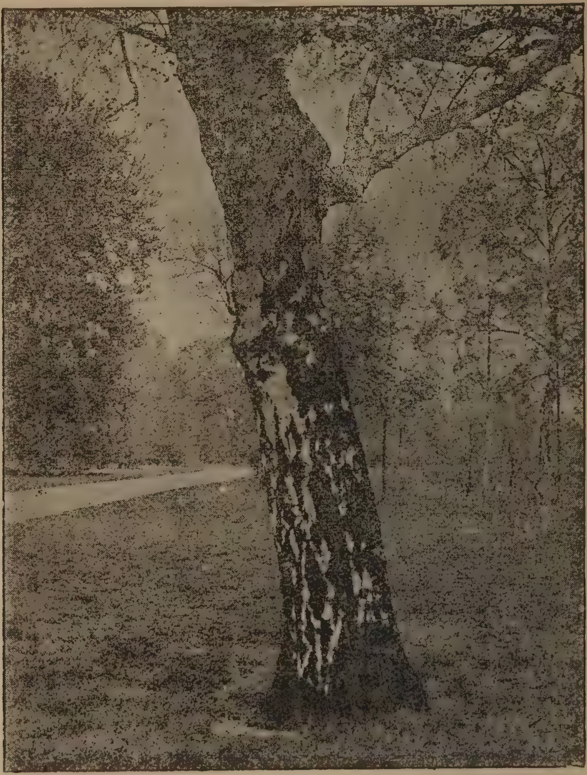


Fig. 6.—White Birch.

and its subsequent conversion by the plant into oxalate, in which insoluble condition it is deposited in the cells.

In obtaining photo-micrographs of sections of bark, it is not absolutely necessary that the section should be stained, although, of course, staining materially assists in differentiating the various tissues, the two stains usually employed being red and green; some tissues appropriate red, while other tissues select the green; others, again, have no partiality for either, and remain unstained, hence we get at least three results. Of course, it is hardly necessary to point out that if the section is stained, a much more prolonged exposure will be necessary, and an isochromatic plate, and probably a light filter, will be necessary.

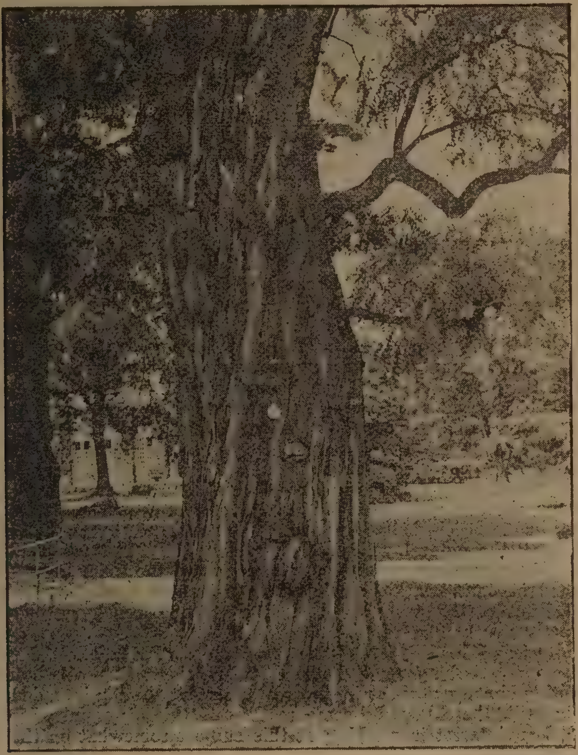


Fig. 7.—Locust tree.

So much, then, for bark sections. I will now say a few words about barks as we see them growing on the trees; and in the first place it must be borne in mind that the part we see, at any rate in trees of any age, is dead. As previously noted, life and growth take place in the cambium layer, between the wood and the bark, the outside layer -- the suberous or corky layer—therefore has no life, and is frequently shed by the tree. Interesting examples of this are to be seen in what is called the greater maple (Acer pseudo-platinus), and in the plane tree (Platinus orientalis), the shed bark of which can always be seen in the trees on the Thames embankment in London, in the autumn about September.

By the kindness of the Editor, I am enabled to show photographs of four trees, out of some dozens I have taken in Kew Gardens, with their name attached, so that there is no doubt as to what they are. These two trees—the black poplar and the yew tree—are as unlike as can possibly be, and yet each possesses characters by which it can be distinguished from other trees. The black poplar might, at first sight, be thought to resemble as far as its bark is concerned the elm or the oak, but on comparing them it will be seen that there is a difference between all three. The yew is not likely to be confounded with any other tree. And then I illustrate two more very characteristic trees, viz., the Robinia pseudacacia, or locust tree, and the Betula alba, or white birch. The bark of acacia trees is easily told, runs from the ground upwards in a very pretty sinuous or wavy line, and this tree is easily picked out from among others; while the birch (betula alba) must be equally as well known. The bark of this latter tree is stated to be so very durable that the peasants in Sweden and Lapland, &c., at one time used to cut it into the form of tiles, and employ these in covering their houses.

Then, again, bark may be roughly divided into the rugged, as illustrated by the oak, elm, &c., and the smooth, of which examples may be seen in the beech, holly, ivy, &c. The reason of this is that in the rough bark the outer layer, not being able to expand sufficiently to withstand the pressure caused by the growth of the inner layer (liber) the wood becomes cracked; while in the smooth bark, expansion is provided for, partly by the small development of parenchymatous cells, and partly by their great distensibility.

I sadly fear I have exceeded the space which may be allotted to me, and I am not without some doubt as to whether, after all, botanical descriptions have not crept in to greater extent than I intended they should; still, there may be some readers of this communication who may feel an interest in working at this subject somewhat on the lines herein indicated.

FERRIC AMMONIUM CITRATE (GREEN FORM).

By Ons.

In many forumlæ given for the preparation of "blue printing" papers, and also in papers in which the image is produced by substitution, there is given an alternative form of ferric ammonium citrate, of a green colour, and which possesses some remarkable properties, among which is great sensitiveness to light, being far more so that the common brown variety; as this green variety cannot, so far as I am aware, be procured in England, a few words upon its manufacture may be of interest. Ferric hydroxide is dissolved in citric acid, and ammonia added in proper proportions, but as bought ferric hydroxide is generally largely ferric oxide, and it is advisable to prepare it directly before use. 32·5 parts of ferric chloride are dissolved in a small quantity of water, and the hydroxide precipitated by the addition of ammonia in excess. The bulky reddish brown precipitate is then washed free from ammonia either by decantation, or in a fine linen bag, using hot water preferably to accelerate the washing. The precipitate should be drained until in a fairly thick paste, and then warmed to 60 °C.; 84 parts of powdered citric acid are now thoroughly stirred in until the ferric hydroxide is dissolved, and a dark brown solution obtained. If difficulty be found in dissolving, add a small quantity more water. The solution is then cooled, and 36.7 parts by weight of ammonia of .880 sp. g. are then added. The solution at once heats up to about 60°C., and turns to a clear dark green solution. This should be filtered through cotton wool, and is green ferric ammonium citrate. As it is very difficult to obtain this as a solid owing to its deliquescent nature, it is advisable to make a solution of known strength, and the above solution should be diluted until of sp. g. 1.18 at 15°C., it is then a 50 per cent. solution. This must be considerably diluted for use. The solution will not keep longer than about two months, and should be carefully preserved from light, as it is very sensitive.

STAINED FINGER NAILS.

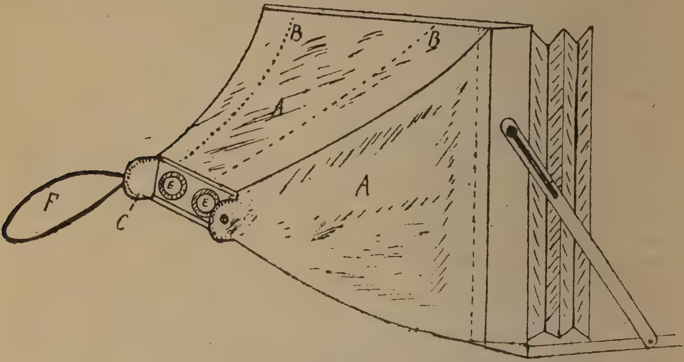
By F. H. Glew.

Before commencing developing, the first finger and thumb of each hand should be dipped into a wide-mouthed bottle containing a little flexile collodion (sold by all chemists). In a few seconds the collodion sets on the fingers and forms a protective layer, which does not impede the most delicate sense of touch, and yet effectually prevents any staining action on the nails or cuticle, and also protects from irritant solutions. When the work is finished, the collodion film is quickly and easily removed by means of a rag moistened with methylated spirit, or by simply dipping the fingers into another bottle containing methylated spirit and ether in equal volumes.

AID TO FOCUSSING.

By J. A. C. Murray.

The old-fashioned focussing hood or bag for outdoor work seems to be coming into favour again, and I think one or two slight modifications will be acceptable to some. The hood is of the usual conical form, fastening by strong elastic round the end of the camera, and, instead of the narrow end being open, has fixed into it a pair of magnifying lenses of suitable power, and mounted on cardboard to suit the eyes. The end of the hood is sewn over a small frame of strong copper wire, which can be fitted to the face by bending the wire, and so keeps out all stray light. From the wire frame to the edge of the hood fitting the top of the camera are fastened two pieces of thin elastic, long enough to allow free motion of the head, and at the same time keeping the hood from sagging or hanging down so as to interfere with the image on the focussing screen. The use of the lenses, besides facilitating the focussing, allows of a much shorter hood being used. For a ½-plate camera I made the hood of black suede glove leather; it is perfectly light-tight, and hardly any weight.



DEVELOPING PLATES OR FILMS AND PRINTING ON GELATINO-CHLORIDE PAPER DURING HOT WEATHER.

By J. T. Hackett.

During the last two or three summers the weather has been unusually hot for England, especially in the sandy districts of the country.

I, and no doubt many other photographers, have had the misfortune to see the gelatine film of the plate dissolve in the developer, or of the finished negative running when set up to dry, instead of drying. The foregoing experiences set me thinking as to what I had best do in order to overcome these difficulties.

At last I was able to prevent the gelatine film from melting, &c., by working in the manner described below, an account of which I thought would be useful to the many readers of this popular Annual.

As I reside about five miles from a town, it is not easy to procure ice, in order to keep the developer, &c., cool, and I have had no experience with freezing mixtures. I had therefore to seek assistance in other directions. But, as the wells of water in this part of the country are rather deep, it is always easy to get plenty of cold water, as the water level is often from 30 to 40 feet below the surface of the ground.

I therefore procure the water for washing, &c., from the well, a short time before it is wanted for use.

It is well known that the temperature of the atmosphere decreases rapidly after sunset, until about 6 a.m. the next morning. It is therefore easy to see that, whenever possible, night is the best time to develop gelatine plates or films. I therefore always develop at night in hot weather, for this and other reasons, whenever possible.

As the kind of developing agent and alkali employed either favours or retards the softening or melting of the film, it will well repay any photographer to try a few experiments with different developing agents and alkalis during hot weather,in order to find out those that tend to retard or prevent the film from softening or dissolving.

So far as my experience goes, I have found pyro and ammonia and metol and carbonate of potash the best developing agents and alkalis to employ during hot weather. Ortol and carbonate of potash also have a toughening effect upon the film, I have read. Hydroquinone, eikonogen, amidol, and glycin appear to me to have a tendency to soften the gelatine film during hot weather, and caustic soda or caustic potash are also best avoided for the same reason; so it will be best not to use them with plates that have soft or tender films, for obvious reasons.

The Ilford, Gem, and Imperial brands of plates appear to be well suited for use during hot weather, as they have tough films; there are probably several other brands of plates equally good in this respect.

If the photographer is the fortunate possessor of an underground cellar, I advise him to make a dark room in one corner of it, for use during hot weather, as then he can, with a little care, develop, &c., at any time of the day or night, with perfect safety to his dry plate films and comfort to himself while at work.

If the photographer is obliged to develop in the daytime during hot weather in a dark room above ground, he had best soak his plates in a solution of formalin previous to developing them. The following formula is copied from the "Gem Almanac" for 1900, and it answers well:—"Formalin is a hardener of gelatine, but must be used with great care. It is better not to use it with the developer, but separately. The usual strength sold is a 40 per cent. solution. It is not advisable to use formalin in the developer. The plate, however, may be soaked for five minutes in—

Water	10 ounces,
Formalin, 40 per cent.	60 drops,

before development, washed well, and then developed." Another formula (the "Paget") for the same purpose, and used for the same time and manner, is—

Water	10 to 20 ounces,
Formalin, 40 per cent.	1 ounce.

So from the above it would seem that the exact strength of the solution is not very important, or else that some brands of plates may require a stronger solution than others. I have found the first formula answer well, and it is also effective if used for five or ten minutes after fixing and washing in preventing the negative film from melting when put to dry. The negative must be well washed after treatment with the formalin solution.

I have also found it an excellent plan to use formalin in the fixing bath during hot weather, which information I obtained from "Paget's Handbook," No. 1. The formula is—

Hypo solution for fixing negatives	20 ounces,
Formalin, 40 per cent. solution	1 ounce.

Whichever way the formalin is used, the film, after fixing, is so tough and insoluble that the negative may actually be washed in water hotter than the hand can bear, without any sign of softening. The negatives treated with formalin also dry much more quickly than usual.

As it is very important that the negatives should be dried as quickly as possible during hot weather, no matter whether the above precautions have been taken or not, it is wise to wipe the backs of the negatives with a piece of dry rag, and to blot off the moisture upon the film side with a cambric handkerchief, or with fluffless blotting-paper, and then soak the negatives in methylated alcohol for five or ten minutes; then drain, wipe, and blot off as before, and set up to dry in a current of air, and they will be dry in 30 minutes, or less. If placed in the sun they will dry more quickly. During June, July, and August it is not wise to place negatives in the sun to dry, unless they have been treated with formalin or alcohol, or both, as above recommended, or the films may run, and thus ruin the negatives.

I have found that when formalin is used in the fixing bath the plates need not be treated with the formalin solution previous to developing if the temperature of the dark room, the water and various solutions employed do not exceed 80° F., although it might be a good plan to always use formalin previous to developing when the dark room temperature exceeds, say, 78° F., when negatives have to be developed that cannot easily be replaced if they should get spoiled in any way.

I have found it quite possible to intensify negatives with bichloride of mercury and ammonia, after treatment with formalin, although it is quite possible that the amount of density obtainable may not be so great as if formalin had not been employed. If therefore the utmost amount of density is desired, the negative must be intensified before it has been dried, no matter whether it has been treated with formalin or not. The drying with alcohol also tends to toughen the film.

Note.—The same solution of formalin that is employed before developing must not be used after developing or fixing, or vice versa, for obvious reasons.

Gelatino-chloride or Bromide Prints.

During the hot weather it will be a good plan to wash, tone, wash, fix and wash prints upon gelatine papers after 8 p.m. or before 10 a.m., using the coldest water procurable (that from a deep well is suitable) for washing, the bottles containing the toning and fixing baths being placed in a vessel containing some of the same water, so as to bring all the solutions to as near the same temperature as possible. It is important to carry out all the foregoing operations as quickly as efficiency will permit. After the prints are fixed and well washed, if the film is at all sticky, they are transferred to a formalin bath for five or ten minutes—the same strength as the first one mentioned in this article—after which they are well washed again; or a fixing bath containing formalin may be used instead of the above bath. The prints are now placed in a pile upon a sheet of plate glass, and covered with a clean towel, folded several times. A mounting roller, or ruler, is now passed carefully, but firmly, over the whole several times, in order to squeeze out as much moisture as possible. Now lift each print by the aid of a penknife, or otherwise, and lay them out, face upwards, on a sheet of newspaper to dry. When they are quite dry they are trimmed to size, re-wetted and mounted with thick freshly-made starch paste in the usual way. The reason why it is best not to trim the prints before toning, &c. (or only just trim off useless black edges, &c., in order to save waste of the gold during toning) is because their edges are much more likely to get frayed or torn in hot weather than in cool weather. Even when no formalin bath is employed before toning, or formalin in the fixing bath, or after fixing, it is surprising how the simple dodge of drying the prints before the final trimming and mounting is done helps to make the latter operation easy and effective, because the drying alone has a hardening effect upon the film. After trimming five minutes' soaking in water previous to mounting is all that is necessary. It is advisable to use fluffless blotting-paper to place over the prints while being rubbed down during the mounting operation, as then all chance of it sticking to the prints will be avoided.

In very hot weather the prints, after washing, as usual, before toning, may be soaked for five or ten minutes in the Paget formalin bath, viz.:

Water	20 ounces.
Formalin (40 per cent.)	2 ounces.

They are again well washed, and then toned, &c., as usual. Alum can be used instead of formalin, but the latter is much more easily washed out, so I prefer it on this account, and the ease with which the solution is made. It is advisable not to use any of the formalin baths for more than one batch of plates, films, or prints, because they may become charged with any chemical that may still remain in the film, which might spoil any other other plates, negatives, or prints that it might come in contact with.

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FOCUSSING SCALES.

By Henry W. Bennett, F.R.P.S.

Although scales for focussing without examining the image on the ground-glass screen are so frequently used on hand cameras, it is very rarely that the great advantages to be derived from their adoption are appreciated by the users of the ordinary type of camera, and yet there are many occasions when they are almost invaluable in enabling work to be done successfully under circumstances that would render success very improbable or failure almost certain without their aid.

In marine work, for example, the camera may be set for photographing a boat at a certain distance, and at the last moment it may be necessary to alter the setting, so that the object shall be in focus at a greater or a lesser distance; or it may be desired to set the camera for taking a vessel at a known distance when there is no opportunity of focussing an object at that distance beforehand; and in these, as in may other similar instances in other work, the setting of the camera may be altered at any moment right up to the time of making the exposure, with the certainty that the object will be sharply defined if its distance can be fairly estimated. Such a scale is so little trouble to make that this can be no objection to its adoption.

FIG. 1.

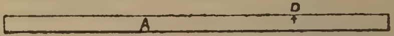


FIG. 2.

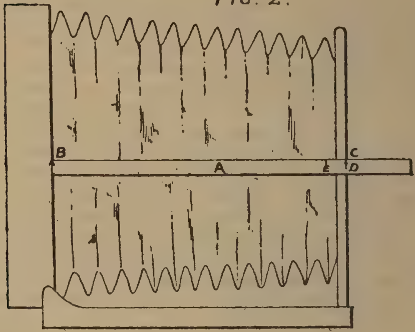


FIG. 3.

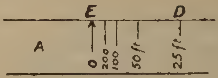
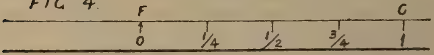


FIG. 4.



The following method is the most simple:—The camera should be set up with the front and back frames parallel, and an object at a measured distance—25 feet is a good distance to select—focussed accurately with the full aperture of the lens by the aid of a magnifier. A thin, flat strip of wood, A (fig. 1), about three-quarters of an inch wide, is then held to the camera, as shown in fig. 2, and the distance apart of two points, B and C, on the front and back frames, marked off on the scale at D; and it is self-evident that if at any time the camera is extended so that these two points are just the same distance apart, as measured by the length from D to the end of the scale, any object 25 feet away will be exactly in focus.

In order to find points on the scale to correspond with the camera extension for other distances, first find that for infinity by focussing an object at the greatest possible distance and marking off the extension on the scale at E (fig. 2), in the same manner as for point D; or, if the focus of the lens is approximately known, the distance from D to E can be easily calculated in a few moments. When the two points, D and E, are obtained, it will be exact enough for all practical purposes if the distance is divided into two equal parts, and the point so obtained marked "50 feet"; the distance from this to E divided again, and marked "100 feet"; divided again for 200 feet, and again if necessary. This division of the scale is drawn full size for a 12-inch focus lens in fig. 3.

A somewhat similar scale saves an immense amount of time when copying drawings or manuscripts to scale. For this purpose the camera should be set up, and an object at the greatest possible distance focussed, and the extension marked off on a scale, as shown at F in fig. 4. Then the camera should be extended until a test object is sharply focussed with the image on the screen exactly the same size as the object itself, and the extension marked off on the scale at G. Now, if the distance between F and G is divided into half, quarter, three-quarter points, &c., as shown, or preferably into 100 equal parts, it will only be necessary, when a copy is required to a given size, to extend the camera to the proportionate figure on the scale, slide the camera along until the image is sharply defined on the screen, and it will be at the same time the required size. Those who have attempted copying to scale by trial and error will appreciate the simplicity of this method of working. It may be noted incidentally that the distance from F to G is the exact focus of the lens; and therefore this distance may be measured off beyond G, so as to enable the scale to be used for enlarging, if necessary.

Marking the baseboard of the camera for the various extensions would not answer as a substitute for these scales, as a very slight error in setting up the camera would render all the points so marked incorrect.

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ISOCHROMATIC PLATES IN INDIA.

By GEO. EWING, F.R.P.S. (Calcutta).

AT the London and Provincial Association the question whether isochromatic plates kept well was very recently raised by a member, and the opinions expressed were more varied than satisfactory. Had the question been put to Anglo-Indians, the reply would have been unanimous: Isochromatic plates do not keep in the tropics. It struck me, however, not very long ago that the general verdict was based on somewhat insufficient grounds. There is nothing in the colour sensitisers used for commercial plates that must of necessity fog the film, and if ordinary plates of any particular make would keep in this country, there was no reason why colour sensitive plates of the same make should not, with a little care, keep as well. This was my opinion, and I put it to the test. In March, 1899, I obtained from England a lot of isochromatic plates of a brand known in India. Half the plates were tinned separately in half-dozen packets, and the others were in the ordinary cardboard cases, without tin casing or any special precaution against climatic evils. I used some of the plates in Kashmir shortly after they came to hand, and found them good. The unused plates were kept on an open shelf all through 1899, down to October, 1900, without any particular care. Then I thought it was about time to try them for photographs of Mount Kinchingunga, and the snowy range of the Himalayas. Here are the results:—The isochromatic plates not in tin preserved their sensitiveness, but were fogged. They showed, however, no trace of damp. The isochromatic plates in tin cases were not fogged in the least, and showed all their pristine colour sensitiveness; but they were very badly marked and spotted by damp, fungoid growths covering the greater part of the film.

Some ordinary plates bought at the same time as the isochromatic plates showed no trace of damp or fog. The conclusion is obvious: Isochromatic plates will keep well in India for two years at least, if packed in tins, and if manufacturers take ordinary care in packing. It will not do to tin London mist with the plates; and the plate-maker who takes the trouble to ensure dry packing in tins of isochromatic plates has the Indian market in his hands.

CARBON PRINTS ON ROUGH PAPER BY DOUBLE TRANSFER.

By Henry W. Bennett, F.R.P.S.

It is becoming increasingly difficult each year to glean some fragment from the season's experience that shall be of sufficient interest or practical value to offer as a contribution to the Almanac. Looking backward on the year's work, it seems to me that the following method of producing double transfer prints on almost any kind of paper, either smooth or moderately rough in texture, might be useful to those workers of the carbon process who wish for something different from the plain, smooth white commercial double transfer paper for those subjects in which the reversal of the single transfer is inadmissible.

The paper to be used for the final support of the print must be prepared in the ordinary manner for single transfer, and the print developed on commercial flexible temporary support and partially or fully dried before attempting to transfer. A solution of gelatine must be made by soaking some of Nelson's No. 1 in water for an hour or more, then draining off the water as closely as possible, dissolving by heat in the water that it has absorbed only, and then adding half its volume of boiling water. The consistency of the gelatine is of very great importance. If it is too thin, the print will not adhere firmly to its support; if too thick, it will be impossible to prevent it from setting before sufficiently good contact is secured between the print and support. This solution must be prepared only when actually required, and kept as hot as possible during the operation of transferring. The paper for receiving the print should be well soaked in water for some time before it is required, so that it may be perfectly soft and pliable, and, when ready for transferring, the print on its temporary support should be thoroughly rewetted in warm water, and as much as possible of the adherent water carefully blotted off. The paper should be similarly blotted, the print placed on the squeegeeing board and sufficient of the warm gelatine flowed over to well cover it, the paper placed quickly in position and firmly squeegeed down. It is then hung up to dry in the usual manner, and when stripped from the temporary support the grain or texture of the transfer paper will be well preserved. After stripping, the print should be immersed in a bath of formalin for a few minutes—commercial formalin, 1 part; water, 9 parts—rinsed in two or three changes of water, and dried.

In describing this method, it sounds somewhat troublesome, but in practice it is certainly not so. Six or seven prints can be easily transferred in a quarter of an hour, and the result would warrant many times this amount of extra trouble.

THE INFLUENCE OF FOCUS, &c.

By Charles Louis Hett.

The photography of small birds in cages is my special hobby. In connection with this subject I have recently had occasion to go into the question of the influence of the focus employed; also the most suitable scale for the purpose. Small birds are very restless subjects, and time exposures are generally impossible. Hence we have the following somewhat conflicting desiderata:

1. Correct perspective.
2. Depth of field in focus.
3. Rapidity.
4. Scale as large as practicable.

With regard to perspective, most photographers hold that a print should be viewed at a distance equal to the focus of the lens with which the negative was taken. This is hardly accurate: the distance selected should be equal to the conjugate focus, which is a very different thing when working to a large scale. At an infinite distance the conjugate and actual foci agree; but when reproducing an object full size the conjugate focus is double the actual. It can readily be demonstrated that the above is strictly correct when one eye only is used. Our double vision has an influence, but one that it would be most difficult to compute. For all practical purposes it is sufficient to bear in mind that on this account the focus employed should be longer rather than shorter than that arrived at by calculation.

If the print is to be held in the hand, the conjugate focus should be the distance of normal vision—that is, 14 inches.

The focus required to give a conjugate focus of 14 inches =

$$\frac{14\,r}{r+1}$$

when r represents the ratio which the original bears to the image on the focussing screen.

TABLE CALCULATED ON THE ABOVE BASIS.

r	f	r	f
1	7	6	12
2	$9\frac{1}{3}$	8	$14\frac{4}{9}$
3	$10\frac{1}{2}$	10	$12\frac{8}{11}$
4	$11\frac{1}{5}$	100	$13\frac{87}{101}$

Many landscape photographers use lenses of long focus; but others, especially amateurs, are content with some 5 or 6 inches.

It is well known that the use of a magnifying lens greatly improves the appearance of most prints. The reason is the greater, or less, correction of the false perspective, introduced by the use of a lens of short focus. Suppose a lens of 6 inches focus to have been employed, and the negative to be magnified two diameters, the print will then appear to the eye in the same perspective as one taken with 12 inches focus (unmagnified). Exactly the same result can be obtained by enlarging. I believe that Mr. Hodges has stated that he finds 7½ inches quite sufficient for landscape work. But, then, Mr. Hodges enlarges two diameters. Therefore the enlarged picture will be in the same perspective as a direct print from a negative taken with a lens of 15 inches focus.

For hanging on a wall the ideal effective conjugate focus would be about 36 inches. That is the original conjugate focus multiplied by the enlargement (in diameters).

Too short a focus gives a flat and unpleasant effect, and makes a statue look like a bas-relief. On the other hand, if a print prepared for the wall is held in the hand, there is an excess of chubbiness, which gives the object an appearance of greater size than it really possesses. I have before me four prints of a writing-table ornament, in the shape of a little elephant. Two of these are one-fourth full size, one taken with a focus of 5½ inches, the other with 13 inches. The other two are the same enlarged four diameters, bringing the image back to full size. Of the smaller ones, that taken with 13 inches focus looks all right, the other appears flat, and gives an uncomfortable feeling that something is wrong with it. The print from the enlargement from the 5½-inch negative is all right. The other, when held in the hand, possesses a preternatural roundness, and gives the impression of larger size. When the two are held side by side, although both the paper and image are of one size, yet the enlargement from the longer focus appears to be larger than the other. This is the only drawback, and is an error on the right side.

So far everything appears to be in favour of the employment of a long focus.

Now we will consider depth of field in focus. It has constantly been asserted that a long focus means a limited depth of focus. This is quite correct, if we accept the commonly received definition of the term—viz., the inverse of the distance from camera of nearest point in focus, when the lens is set for a distant view. Very few photographers nowadays are particularly anxious about the distance, but focus on the object which they wish to form the principal feature; or, in the case of a fixed focus, the lens is, or should be, set so that an object at an average distance is in the sharpest focus.

I will spare the reader the proof of the following formulæ, and ask them to be received as results which have been mathematically worked out:—

If the permissible margin of error be taken as a circle of confusion 1-100 of an inch in diameter, then let—

u = distance from the lens of the point in sharpest focus.
u' ,, ,, ,, nearest point in focus.
u'' ,, ,, ,, most distant point in focus.
f focal length of lens.
e f value of aperture, *i.e.* : $e=8$, when aperture $=f$-8.
r ratio which object bears to the image on the screen, as already given.

Then $u=(r+1)f$

$$u'=\frac{100\,(r+1)f^2}{100f+e\,r} \text{ an } u''=\frac{100\,(r+1)\,f^2}{100\,f-e\,r}$$

$$\text{The depth of field in focus}=\frac{200\,e\,r\,f^2\,(r+1)}{10{,}000\,f^2-e^2\,r^2}$$

$e^2\,r^2$ in the denominator is very small and may be omitted. The formula then becomes

$$\text{Depth of field}=\frac{e\,r\,(r+1)}{50} \text{ or more conveniently } \frac{2\,e\,r\,(r+1)}{100}$$

In the examples which I have calculated the results obtained by the two formulæ only differ by about one per cent., thus showing that the depth of field is practically independent of the length of focus. As a check, we will take e, r, and f, each to equal 10. The result obtained by the full formula is 22.2222. If we substitute f equal to 100, we obtain 22; showing an infinitesimal advantage in favour of the shorter focus. So far as depth of field is concerned, we may leave the length of focus out of the question altogether.

We still have to determine the scale to be employed. This must be considered with regard to its effect on the speed, and also the depth of focus. The choice is not too simple. The larger the scale the longer the exposure required, and the less the depth of field. An examination of the following table will be of assistance in coming to a decision. The first column gives the ratio of the object to the image. The second the aperture in terms of the conjugate focus. The third shows the proportionate exposure; and the fourth contains the depth of field, calculated by the simplified formula. The remainder of the table gives the same information with the *f* apertures at the head of the columns.

r	*f*-5			*f*-10			*f*-15		
	c. f. Value of Aperture.	Proportionate Exposure.	Depth of Field.	*c. f.* Value of Aperture.	Proportionate Exposure.	Depth of Field.	*c. f.* Value of Aperture.	Proportionate Exposure.	Depth of Field.
1	10	4	·2	20	16	·4	30·0	36	6
2	7·5	2·25	·6	15	9	1·2	22·5	20	1·8
3	6·7	1·78	1·2	$13{\cdot}\dot{3}\dot{2}$	7	2·4	20·0	16	3·6
4	6·25	1·56	2·0	12·5	6·2	4·0	18·8	14	6·0
5	6·0	1·44	3·0	12·0	5·7	6·0	18·0	13	9·0
6	5·8	1·36	4·2	$11{\cdot}\dot{6}\dot{6}$	5·4	8·4	17·4	12	12·6
8	5·6	1·27	7·2	11·25	5	14·6	16·8	11·3	21·6
10	5·5	1·21	11·0	11·00	4·8	22·0	16·5	10·8	33·0
12	5·43	1·18	15·6	10.86	4·7	31·6	16·3	10·0	46·8
24	5·21	1·09	60·0	10·43	4·3	122·0	15·6	9·7	180·0
	5·0	1·00	...	10·00	4·0	...	15·0	9·0	...

On the whole the largest scale suitable for all-round use appears to lie somewhere between one-fourth and one-sixth life size. I have tried many scales, and latterly have used one-third and one-sixth life size. I am now of opinion that one-third is too large a proportion. When you are able to give a time exposure, or the light is so strong that you are able to stop down to any material extent, it is quite a different matter. Some of the members of the Zoological Photographic Society have contributed splendid prints about half life size, taken with time exposures.

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SMALL ENLARGEMENTS.

By J. Pike.

To those of our amateurs who have a difficulty in getting through the long winter evenings, I venture to suggest a branch of photographic work which will inevitably interest, and may prove useful and instructive. This is, briefly, simply copying and enlarging work, the enlargements being from one to perhaps not more than four diameters. The requirements are a short-focus rectilinear lens; a stereoscopic lens would do very well if of short focus, the above being used in the presumable absence of a 2 in. or 3 in. microscopic objective; secondly, a camera ¼ or ½-plate capable of extension, or one to which an extension arrangement can be adapted; and, thirdly, a powerful lamp with reflector. The subjects suitable for copying are infinite. Along the seashore, for example, one may find scores of subjects, shells, stones, fossils, and so on, the classes and species depending, of course, to a great extent on the lay of the coast, any one of which, if examined with a glass in a good light, will yield up certain beauties of form and colour not observed with the naked eye. The mere fact of examining some of these common objects of the sea-shore, picked up in the course of an hour or two's ramble, was sufficient inducement for me to endeavour to reproduce them in a more permanent form.

The operations are simple enough. The object is mounted temporarily upon a piece of stout cardboard, and then set up in a convenient position for photographing. The lens used, if it be of quite short focus, will give the necessary amplification without undue strain on the bellows of the popular long-focus camera now so generally used, and, of course, this means that the space occupied by the outfit will not be great. The purely photographic results will depend upon the amount and quality of light at the disposal of the operator—for small objects a condensing lens may conveniently be used for illuminating purposes.

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STEREOSCOPIC GOSSIP.

By Henry Cooper.

It may be interesting to some of the junior members of the photographic world if I attempt to rescue from oblivion a few records concerning stereoscopic photography.

It was in the year 1862 that I first entered the ranks, as a junior, and at once stereoscopic photography became a fascinating study.

I found three or four of our leaders held possession of the field. First, admittedly, stood G. Washington Wilson, of Aberdeen. Living so far north, he was seldom seen in London, but at the Exhibitions in Conduit-street his work was always eagerly sought after by all. There was always an indescribable something about his work which placed him easily in the front rank. Well do I remember the sensation created when the Editors of The British Journal of Photography announced, in 1864, a series of papers from Mr. Wilson's pen. Now the great secret was to be made known. But as the great magician wrote those four or five homely chats so delightfully clear, it became evident it was the old story—he had no secret to tell. It was exceedingly droll, yet disappointing, to read of the "rule of thumb" methods he adopted. He himself attributed much of his success to the use of single landscape lenses, which he always used whenever possible. I think his favourite pair of 6 in. focus, and of French make, fell into the hands of Mr. B. Wyles, of Southport. Certain it is that in a large collection of slides by the best men of that day, I find a charm about Wilson's work which was seldom found in other work.

Following close on Wilson came Francis Bedford. His splendid series of the Thames Valley and of North Wales, published by Catherall and Prichard, of Chester, have never been surpassed. For some time I was in close correspondence with Mr. Bedford, and always found him willing to help his younger brethren. Like Wilson, he always expressed a strong preference for single lenses of 6 in. focus. He would often leave a scene untouched when it could only be worked by very short focus lenses.

Next came the beautiful slides of Mr. W. England. The International Exhibition of 1862 gave him a splendid chance. Probably his series of stereo slides of that Exhibition have never been surpassed. Unlike Wilson and Bedford, England preferred to use for this interior work the new C.D.V. lenses just then brought out by Dallmeyer, and well they served him. After this, for some years, a series of Swiss views were eagerly looked for. Every summer England spent some months at work amongst the valleys and mountains of that beautiful land. And I, for one, very much regretted when his visits to Switzerland ceased.

In the front rank also stood Breese, whose extraordinary "moonlight" studies, which I first saw in the Exhibition in Conduit-street, I shall never forget. They were so cleverly made up as to completely puzzle photographers, and it was only later that Mr. John Hamer, his former assistant, described in the columns of the Journal the extraordinary pains taken to produce such perfect results.

Last, but not least, in excellence we had the instantaneous stereographs of Valentine Blanchard. It would open the eyes of many modern workers if they could see the beautiful work sent out by these indefatigable workers.

Besides these worthies, other excellent workers in America often sent us their work. The question often arises in my mind: "What has become of all this beautiful work?" Much of it has been destroyed; but much of it must still be in existence.

Have these leaders, or such of them who are still with us, any conception of the pleasure they were then, and are still the means of giving, many of the happiest hours of my life having been spent by means of their assistance?

In those days an enormous industry was created in the sale of these slides. Pity that it was destroyed chiefly by the indecent filth of French and German, which our English taste revolted from.

A WELL-KEEPING AND CONVENIENT PYRO DEVELOPER.

By R. Zahr.

Notwithstanding the fact that several of the many newer dedevelopers show excellent qualities in their way, a goodly number of photographers, both professionals and amateurs, still firmly adhere to their favourite, old pyro. And very many more, especially of those who have joined our ranks more recently, would gladly use that prince of developers if they were not afraid of its supposed great drawbacks: its liability to stain plates, fingers (and clothes), and its non-keeping property. Now, it must be confessed, there are developers less prone to stain a plate than pyro as it is frequently made up. But there is an easy way to prepare a thoroughly clean working pyro solution by means of a preservative that gives at the same time to the concentrated solution such excellent keeping property that it will not lose its developing energy to any perceptible degree in several years' time (if kept in well-stoppered full bottles). The suggestion of this very useful preservative, metabisulphite of potassium, we owe to that veteran photo-chemist, Mr. J. W. Swan, to whom photographers are indebted in many ways. It was, I believe, in 1886 that he gave a formula for keeping pyro in solution together with metabisulphite of potassium. But it seems that the action of this salt, and the function it has to fulfil in the developer, may have been misunderstood in some quarters, and it has not been able to gain the popularity it deserves to find. When pyro was first used as a developer for dry plates, it was put up with alcohol, glycerine, sugar, and the like. Later on, acids served to preserve aqueous pyro solution in tolerable condition for a certain—pretty limited—time. Then Berkeley gave his formula, in which he kept the pyro together with sulphite of soda solution, acidified with citric acid. But soon it became known that the use of the sulphite was not so much in preserving the pyro in solution as in preventing the negatives developed with pyro and the carbonates (which at about that time began largely to replace the water ammonia) to acquire an ugly, non-actinic yellow or yellow-green colour. In 1884 I published a formula, in which the pyro (1 oz.) was dissolved in water (6 oz.), acidified with (30 or 40 drops) nitric acid, and the carbonate of soda, sulphite of soda, and water formed the other solution. These stock solutions were mixed in due proportion, and diluted with the sufficient quantity of water, just as the kind of plate used or the object to be photographed demanded. Attention was called to the fact that the necessary quantity of sulphite of soda depended on the particular kind of plate used and the colour of the negative desired. I personally preferred a neutral grey, as neutral as possible, but as grey either leans towards the bluish, or otherwise towards the yellowish, I put in just enough sulphite to give a grey negative the least bit yellowish, as that shade of colour has excellent printing quality, allows to judge of the density of a negative correctly, and is very nearly uniform with the colour of the retouching pencil. The pyro kept well for a few weeks in that concentrated acidified solution. I believe this was the first pyro formula in which the sulphite was not put into the pyro, but in the soda solution, and it was attacked accordingly, one writer asking sneeringly what in the world the author of this formula meant to use sulphite for if he did not put it up together with the pyro? As soon as metabisulphite of potassium appeared on the field it was seen that this most excellent of all known preservers for pyro solutions would give pretty near perfection to pyro formulæ. But we must strictly keep this salt to its legitimate use. It has not to replace the sulphite, but simply to preserve the pyro, and the quantity needed to do this is comparatively very small, and depends on the concentration of the solution and upon the time we want to keep it. A ten per cent. pyro solution which will work six months after it is made as quickly and cleanly as on the first day will require of potassium metabisulphite one-tenth of the weight of the pyro, so we may dissolve one part of potassium-metabisulphite in 100 parts of distilled water, and as soon as it is dissolved completely, not before, add 10 parts of pyro. If we want to make up solutions of such a strength that equal parts of them without any addition will give the developer ready for use, we take more of the preserving agent—about one-fifth or one-fourth of the amount of pyro. To take more than this is quite unnecessary, or even hurtful, for the free sulphurous acid given off by the salt will neutralise an equivalent amount of the alkali, and in this way retard development. In some formulæ we see equal parts of pyro and of metabisulphite described. This large amount of the preserver adds to the expense of the developer, and yet cannot fulfil the function of the usual amount of sulphite to give the right colour to the negative. The pyro-bisulphite solution ought to look a pale greenish-yellow, and will acquire, in time, a slightly more intense colour, but remain absolutely clear, and the mixed developer will, if the correct amount of sulphite be given in the soda solution, look as clear and colourless as pure water. This is a good test as to whether the solutions are made up correctly, or whether the chemicals are of sufficient purity. By the way, in the formula made up in the above manner, the strictly neutral condition of the sulphite is not of such a great importance as in the formula where the sulphite and the pyro are in one solution. But it is well to look out that we get the right quality of the potassium-metabisulphite, as there are several cheaper samples in the market that will not do at all as preservers for pyro. The salt—if good, is sold in medium-sized crystals, white and translucent—smells quite perceptibly of sulphurous acid, the smell being much stronger after it is dissolved. Here, in Germany, a very good house to buy it from is Dr. Theodor Schuchardt, in Gorlitz; in England, of course, it may be purchased in best quality from Mawson and Swan, and perhaps from many other houses not known to me.

In these times ease of working, simplicity, and saving of labour are the orders of the day, hence the widespread use of ready-made one-solution developers that require only to be diluted with water to be ready for use. It is quite possible to compound a concentrated pyro developer in one solution, but I should not recommend it. A good, simple, and convenient developer is that given below, which is identical in formula with a developer sold in rather large quantities in Germany. It has stood the test of time for several years, will keep in full energy for more than one year, and only requires that equal quantities of both solutions are mixed to be ready for developing. Take

Solution 1.

Distilled water	1000	parts (or c. c.).
Metabisulphite of potassium	5	,, (or grammes).

When this is dissolved, add

Pyrogallol	20	parts (or grammes).

Solution 2.

Water	1000	parts (or c. c.).
Carbonate of soda (crystals)	80	,, (or grammes).
Sulphite of soda (crystals)	100–160	,, ,,
Bromide of potassium solution (1:10)	5	,, ,,

To develop take equal parts of 1 and 2.

In English measure (and round figures) the formula might stand thus:—

Solution 1.

Distilled water	20 ounces.
Potassium metabisulphite	40 grains.
Pyro	160 ,,

Solution 2.

Water	20 ounces.
Carbonate of soda (crystals)	640 grains.
Sulphite of soda (crystals)	1¼–2½ ounces.
Bromide of potassium	4 grains.

Equal parts of 1 and 2.

This will give about 4 grains of pyro to the ounce of developer, and 16 grains of carbonate of soda. Of course, the amount of pyro may be modified in solution 1, according to the requirements of the particular plate used. It may vary from 100 to 180 grains, the amount of potassium-bisulphite being altered in proportion. It will not be necessary here to tell how the developer is to be modified for over or under-exposure, or to give plucky or soft negatives. Development is finished in about three to four minutes, and the used developer has a pale sherry colour, but does not show the least muddiness, and the plates, especially if fixed in the acid fixing bath, are clean and free from any stain. If the fingers be wetted before clipping in the developing solution to take out the plate to hold it against the dark room lamp, any slight staining will wash off with the greatest ease. The acid fixing bath (composed of hypo, sulphite of soda, and sulphuric or citric acid) is very much to be recommended where cleanliness of working is sought after. If for any reason it should not be thought fit to use it, the plate may be, after fixing in the ordinary hypo bath, rinsed for a few seconds under the tap and treated for a minute or so with the well-known Edwards' clearing bath (alum, citric acid, ferrous oxalate, and water). In his position as chemist and technical superintendent of a dry plate factory, the writer has in the course of years developed, or has seen developed under his superintendence, thousands of negatives with pyro developer of similar or identical formula as that given above side by side with almost any existing developer from ferrous oxalate to adurol and pyro-catechin (or kachin, as it is called now); and he can declare that whenever technical excellence, absolute cleanliness, the greatest possible amount of gradation, fine grain, and last, but not least, quick printing is desired in a negative, pyro developer is invariably made use of. It will not be necessary to sing the praises of pyro at this time of our photographic experience, but it is interesting to note that amongst the recommendations given to the more recent developers, viz., adurol, ortol, kachin, not the least is working and giving a negative very similar to pyro. Yea, even kachin has been lauded forth as stainless pyro! It is only since a few months that pyro was put upon the market in a far more convenient form than ever before, in comparatively larger sized crystals, having only about 1-15 of the bulk of the pyro as usually known in flakes, thus being far more easily weighed off, while it dissolves almost as quickly. The price is even lower than before (at least, here in Germany), and this brings me to a point which may be considered by those who have to look at the pecuniary side of things. Pyro is by far the cheapest of all developers. Let me add only one grievance yet, and I have done: Why call this old, trusty friend who has so long been with us, now it is appearing in a newer, more convenient form, by another name? Wherefore "Pyrol" or "Pyraxe?" Let it be Pyro in Crystals.

ON THE KEEPING QUALITIES OF UNTONED PRINTS ON P.O.P.

By Matthew Wilson.

Gelatino-chloride paper has figured so prominently of late years in the literature devoted to the exposition and advancement of photography, and has secured such an amount of attention from all classes of workers, that a word of apology seems almost due to the reader for the choice of so threadbare a theme for the subject of this paper. I may, therefore, state that what I am about to say will at least possess the saving grace of brevity, and also that my remarks, so far from being of a discursive nature, will tend only to emphasise a point, the importance of which, so far as I have been able to learn, has received as yet no proper recognition. What I allude to is the absence, in an untoned print in this medium, of any tendency to deteriorate in the interval that elapses between the operations of printing and toning. In its practical bearings this is a most valuable property.

An untoned gelatino-chloride print, if properly preserved from damp and access of light, may be kept for weeks, or even months before toning and fixing, and yet, notwithstanding the delay, on the conclusion of these operations the result will be found equal in all respects to what would have been obtained had it been toned and fixed in the usual way immediately after printing.

In this respect it will be admitted that gelatine, as a vehicle for silver printing, compares very favourably with its still popular predecessor and latter-day competitor, albumen. Innumerable attempts have been made, both by chemical and by other means, to improve the keeping qualities of albumenised silver-sensitised paper. The results, as a rule, have scarcely justified anticipation. Experience shows that under the most favourable circumstances it is hardly practicable to postpone the operations of toning and fixing for more than a few days when printing on albumenised paper. A longer interval almost invariably spoils the appearance of the print, the high lights of which now assume a yellow hue. When transferred to the toning bath, the gold is deposited on the image so sparingly and irregularly that, after fixing, its colour is far from agreeable. Further delay serves to increase the difficulties of toning, and finally, after the lapse of a certain time—say, from one to two months—it will be found that the print refuses to tone at all.

In its behaviour under similar circumstances a gelatino-chloride print affords a striking contrast. There is no yellowing of the high lights, no increase in the duration of the toning process, and no irregularity in the action of the gold bath. Toning simply proceeds as usual, and, after fixing, there is nothing lacking in the quality of the print that can be attributed to the special treatment it has received.

With regard to the question as to how long a gelatino-chloride print may be kept between printing and toning, it is to be regretted that at the present stage of photographic knowledge the information available is insufficient to enable a definite answer to be given. Speaking from my own experience, which is, of course, necessarily very limited, I find that two months may have passed since the exposure of the paper to light, and yet good prints can still be obtained. Using the borax bath, excellent prints can also be obtained in from two to three weeks after the printing operations, and prints of equal merit after the expiry of one month, the sulphocyanide bath being employed.

In the printing operations just referred to I made use of several distinct brands of P.O.P., a preference being, however, given to those by well-known makers. In the matter of suitability for the special purpose in hand, it was found that there was practically no difference in behaviour between one make of paper and another. All alike afforded prints capable of being preserved untoned for a considerable period without detriment to their appearance in the finished state.

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WITH CAMERA AND MOTOR-CAR.

By Edgar Scamell, F.R.P.S. (member of the Automobile Club of Great Britain).

Every photographer, be he ever so energetic, must have sighed at some time or another for a ready means of carrying, without fatigue, at least his camera, and oftentimes would be glad to be himself conveyed with it. Many have turned to the cycle, and have found satisfaction where a small kit only has to be carried, for few would care to trundle a regular carrier tricycle for the benefit of easily carrying, say, a 12 by 10 outfit. To those who desire to travel comfortably with apparatus of any size I would commend the motor-car.

To those who have not tried, pictures of numerous breaksdown and excessive vibration possibly present themselves. Now, the average photographer is more or less of a "handy man," and will not object to use his hands to tighten up nuts with a spanner or oil a bearing when occasion requires, and it is from the want of such little attentions as these at the proper time that most of the failures occur. Our highways are not yet as level as billiard tables, and any vehicle, a motor-car included, which travels over them is subject to vibration; but when a motor-car is travelling it is not shaken any more than a horse-drawn vehicle, and from the fact of many being fitted with pneumatic tyres, the jolting is often considerably less. If the driver of a motor-car is somewhat lazy, upon stopping the car for a short time only he will allow the engine to continue running, simply to save the trouble of starting it again. It is then that the car is shaken on its own springs. As starting the engine is not a long or tedious operation, it certainly gives the general public a better impression, if the halt be for longer than a minute or two, to stop the engine when stopping the car.

Some of my own experiences may be of interest. After cycling for fifteen years, I, two years ago, purchased a small two-seated motor-car, and was not long in gaining sufficient confidence to drive it anywhere, and to find its capabilities in the way of speed (this is not excessive), and hill-climbing power. The ready way in which luggage can be carried soon prompted me to carry apparatus upon it, both for business and pleasure purposes. I will give two short examples of its business use from actual experience. In early spring, with muddy roads and slight showers, alone I travelled eight miles through the North-west London suburbs, carrying a 15 by 12 camera, &c.; arrived ten minutes before my appointed time, having saved at least half an hour on the time the railway would have taken for the distance, it being a cross-country journey.

On a hot dusty summer day, together with a passenger, ran eighteen miles north-east of London, carrying a 12 by 10 and a half-plate camera, thoroughly enjoyed the outing, although on business bent; saved three-quarters of an hour on the railway time, arrived about half an hour early, saved all bother of taking apparatus to the station, changing trains at least twice, and a two miles tramp at the country end, and was able to start back for home immediately my work was finished. When out for business I have never failed to reach the appointed place in good time, and have run all distances up to thirty-five miles out. When out for pleasure, have often been further than this. It will be understood that I refer to a car driven by oil (strictly speaking, spirit), the consumption of which in my case works out at a gallon for thirty-five miles, or about three miles for a penny. An electric or steam car of the same power would cost about a penny per mile.

A small car costs, new, from £150 to £200, but a serviceable second-hand one may be had in the neighbourhood of £100. There is no car yet made of the "press-the-button" order that will prove absolutely reliable in the hands of a man whose fingers are all thumbs. The perfect car is not to be had, neither is the perfect plate, shutter, or any other human device.

Should your kind reader contemplate buying, there is no use in waiting until motor-cars are further improved, whilst, if used for business purposes, you gain its value as an advertisement by buying soon, for cars are still somewhat of a novelty. As compared with a horse, they require no attention or feeding when in the stable; they do not run away when left unattended by the roadside, and after a run of twenty miles are just as fresh as at the start, and are ready for another twenty. Finally, I have not been troubled with excessive dust causing pinholes on my plates. In fact, the worst examples of this defect have occurred to me after carrying the camera per cycle.

EPITOME OF PROGRESS IN 1900.

Compiled by the Editor.

COLOUR PHOTOGRAPHY IN 1900.

NEW EXPERIMENTS WITH LIPPMANN'S PROCESS.

Dr. R. Nauhauss reported, in the "Photographische Rundschau," on the experiments which he made in 1899 on the above subject and excused himself for the reason that there are many questions raised which ar not only of special interest for this process, but also of general interest, and he points out that, if a Lippmann photograph be left for any time in the fixing bath, it completely disappears, as the silver is dissolved by the hypo, whilst it is well known that an ordinary negative may be left for a whole day without ill results; further, it is absolutely necessary to develop a Lippmann photograph at once, or the image will be considerably worse. Further, he asks the pertinent question: Why is it, if one of these photographs be soaked in water before development, the latent image is weakened?

Also, by sensitising the finest-grained plates with dyes, different experiences are met with, for the plates sensitised by bathing in solutions of dyes differ considerably as regards colour sensitiveness from those for which the emulsion was coloured, and it is unfortunate that all orthochromatising experiments are carried out by baths.

His recent experiments have been in the direction of utilising albumen plates for the reduction of compound colours. He had already pointed out that careful production of the finished pictures with very dilute hypo and ferridcyanide reducer was an advantage, but that the process was very uncertain.

Assuming that the superficial gold glaze which appeared on these albumen results was due to contact with the mercury, he attempted to avoid this by protecting the film, and for this purpose the sensitised plate was coated with pure albumen and then strongly whirled. The results were, however, absolutely negative, as was also the case when two to three per cent. solution of gelatine was used, though then Newton's rings were seen, the colour of which was dependent on the thickness of the gelatine coating.

Harking back to some of his earlier experiments with a mixture of albumen and gelatine, he tried the saturation of the prepared albumen plate with gelatine. The sensitised albumen plate, after treating with the dye, was laid for ten minutes in a two per cent. solution of gelatine, heated to 508 C. and then vigorously whirled; but even the thin gelatine skin then left on the plate was found to be prejudicial, so the plate was rinsed with hot water and then whirled. The result was striking. A plate thus treated and exposed in the spectrograph showed that, as regards the brilliancy of the colour, it had the character of a gelatine plate, and that with compound colours they were correctly reproduced just as though a gelatine plate had been used.

Whilst the plate is left in the hot gelatine solution it should be brushed with a soft brush in order to remove air bubbles.

The plates treated in this way showed a somewhat lower sensitiveness to red, and this was obviously caused by some of the cyanine in the albumen film being destroyed by the gelatine. In order to avoid this, enough alcoholic cyanine solution (1:500) should be added to the gelatine solution to give it a light blue colour.

In order to decide whether it was only the hot bath or whether the gelatine was essential, the plate was treated with hot water only, with the result that the colours were as bad as with the albumen plate not treated, thus proving the necessity of the gelatine. It was noted here that an albumen plate when sensitised could be left for ten minutes in boiling water without causing the albumen to coagulate or it to lose its developable qualities. A plain albumen plate thus treated was coagulated immediately.

Further experiments enabled a much simpler process to be discovered, whereby the four processes were reduced to two. Thus, after the plate had been sensitised in the silver bath and washed for fifteen minutes, it should be placed for five minutes in the following solution, heated to 508 C.:—

Gelatine solution (2 per cent.)	400 c. c.
Cyanine solution (1:500)	10 ,,
Erythrosine solution (1:500)	10 ,,

Then rinse with hot water and dry. The dyes will keep for a long time in the hot gelatine solution without precipitating.

Arising from past experiences, some experiments were made to try and trace the cause of the superficial golden glaze on albumen plates when taking compound colours. Compound colours can also produce this golden glaze on gelatine empulsion plates if the plate is over-sensitised for yellow and green, which frequently happens when sensitising with erythrosine for yellow and yellowish-green, and they have not the necessary sensitiveness for blue-green. With albumen plates the over-sensitising for colours can be demonstrated most excellently. If the silver albumen plate is bathed only in a cyanine bath, the whole of the surface with compound colours appears covered with a reddish metallic glaze, and the red which is contained in all the compound colours alone appears. Exactly the same occurs with respect to yellowish-green when only sensitised with erythrosine.

We possess now, however, as will be seen later when we come to speak of gelatine plates, an excellent sensitiser for blue and green. If a gelatine plate is sensitised with cyanine, erythrosine, and glycin red, absolutely closed bands are obtained in the spectrum, and the metallic glaze is avoided, which is the proof of the over-sensitising with erythrosine. Experiments proved that glycin red was not so useful for albumen plates as to warrant its use.

Professor Wiener has shown (Wiedmann's "Annalen," 1899, p. 488), both by calculation and experimentally, that the surface reflection in Lippmann's photographs considerably alters the colours, and that it is necessary to get rid of this by cementing on a cover glass.

Dr. Neuhauss found that some kinds of albumen clear very much quicker than others, some taking a few days and others several months. Cleared albumen, which had been kept two and a half years, was absolutely unchanged. When cleared albumen is exposed for a long time to sunlight, it darkens considerably, but this darkened albumen presents no advantage for this work. As several kinds of albumen show a great tendency to blister and slip off the glass, trial was made to make the albumen adhere better by treating it with formalin. With a one per cent. solution the albumen dissolved instantly, with a five per cent. solution it began to dissolve at the edges, with undiluted formalin the film became soft, but did not dissolve, but, when sensitised after, this plate was absolutely insensitive to light.

If an albumen plate be laid in the agfa intensifier, it behaves rather curiously; in a few minutes the silver deposit becomes denser, and in some cases the colours are better. By continued action the plate bleaches and a white-surface fog forms and the colours disappear, but by treatment with amidol the fog disappears, the colours reappear, but are defective. When soaked for twelve hours in this intensifier, the plate is completely bleached, and by subsequent treatment with amidol a silver glaze appears as though the whole of the surface were silvered, but every trace of colour disappears.

Working with gelatine plates during this last summer was extraordinarily successful, and it proved that, if the approved formula be followed, failure can hardly occur.

Our experiments were directed, in the first place, to simplify the preparation of the plates. The washing of the emulsion after the coating of the plates is by no means so simple when a large number (two dozen or more) of plates are to be prepared. The unwashed emulsion ripens very quickly. The coating of the plates must be done with the greatest speed, and there is always the danger that the plates first coated will be already dry on the marble slab, and that the films will be spoilt by the crystallising out of the excess of the salts before the whole of the plates have been coated. Moreover, especially in the cool of the year, the drying of the washed plates is accompanied by many inconveniences. Even when well whirled there will be formed on the washed plates, during drying, figures like the cells of the honey bee, by the remains of the liquids, which, by altering the sensitiveness of the gelatine film underneath, are unpleasantly noticeable on the developed plate. By using distilled water as the last washing water, and by the use of artificial heat in drying the plates, this fault can be partially, but not completely obviated.

All this is avoided if the emulsion is washed, as in the preparation of very sensitive ordinary plates, before coating; but this method cannot be used with plates for Lippmann's process, as any ripening of the emulsion during a long washing has to be avoided. In his book, "Photographie in naturlichen Farben" (published by Wm. Knapp, Halle a. S., 1894), Valenta advises the precipitation of the emulsion by alcohol; that it should be broken up finely, washed, and again bringing it up to its original volume with water, and then, after the addition of the necessary dyes, coating the plate. Exclusive of the fact that this process is very costly in consequence of the large quantity of alcohol that must be used, we could never obtain satisfactory results with it. After several failures, another method gave us the best results: The mixed emulsion, with the dyes added, is made to set as quickly as possible by means of ice water, and is broken up by pressing through fine-meshed muslin. The breaking up must be much finer than with ordinary ripened emulsions, so that the washing may be done as quickly as possible. The broken-up emulsion should be placed in an emulsion filter, such as supplied by Braun (Berlin, Koniggratzer-strasse, 31). The larger mouth of this filter should be covered with muslin and one layer of fine white mull. Washing is effected as follows: The flask is quickly plunged in a pail filled with water, so that the larger mouth of the filter is underneath. Whilst the air escapes from the small opening, the water penetrates through the larger opening of the materials, with some force, into the filter, and stirs up the broken-up emulsion. As soon as the filter is full it should be quickly raised from the pail so that the water runs out, and, in order to avoid the blocking up of the pores of the stuff by the gelatine, the filter should be vigorously shaken.

This process should be repeated for fifteen minutes, and the emulsion is completely washed with safety. A trial showed that even after five minutes' washing scarcely any noticeable trace of the excess salts was present in the emulsion. Finally half a litre of distilled water is poured through the smaller opening of the filter, and it should then be allowed to drain for two hours at least, in order to remove as much as possible the excess of water which is sucked by the emulsion as by a sponge. The last traces of water are driven out by a gentle pressure of air obtained by an indiarubber ball. After melting at about 35° C. the emulsion is ready for coating.

Obviously, by washing, a portion of the dye is removed, but this also occurs when washing the coated plates. It would obviously therefore be more convenient to add the dye after washing; we never obtained satisfactory results, however, with such experiments. It appears as though certain constituents of the dyes must be washed out.

An emulsion thus prepared will keep from two to three weeks in a cool room. The most satisfactory point is that the washed emulsion does not subsequently ripen in a cool temperature; unwashed emulsion ripens even in the cold, so that even after two or three days it is quite useless for Lippmann's process. Washed emulsion, by which the preparation of plates in large quantities is rendered much easier, can be heated to 45° C. without its usefulness suffering, only at 50° does it become cloudy by ripening.

In the "Bulletin de la Societe Francaise" (1890, No. 4), Professor Lippmann published his present method of emulsion preparation, which shows certain variations from the usual methods. Lippmann uses for sensitising a surprisingly large quantity of dye, especially cyanine. Whilst according to Valenta's formula 1: 2 c. c. of cyanine solution (1:500) should be used for 100 c. c. of emusion, Lippmann takes 6 c. c. of cyanine solution to the same quantity of emulsion, besides 3 c. c. of an alcoholic solution of chinoline red (1:500) for the green sensitising. Now, it obviously depends upon the duration and the vigour of the subsequent washing how much dye remains in the emulsion. It should be specially noted, too, that Lippmann uses an alcohol bath before washing.

By testing the quantities of dyes prescribed by Lippmann we could not determine that there was any improvement in the rendering of the red by the copious addition of the cyanine. On the other hand, we gained the impression that the red sensitiveness suffered because the screening action of the dye came into play. However, the various preparations of cyanine behave very differently, and this ought to explain the variations in the results.

With regard to the quantity of silver nitrate and potassium bromide, Lippmann's formula does not sensibly differ from other formulæ, one is confined here to narrow limits. The author has determined that even with double the usual quantity of silver bromide useless plates were obtained.

Very peculiar is the method by which Lippmann adds the silver nitrate to the bromised gelatine solution. Whilst, according to the earlier formulæ, the potassium bromide and silver nitrate were dissolved in separate portions of gelatine solution, and then, with constant stirring, the gelatine solution added drop by drop to the bromised gelatine, Lippmann shakes the finely-powdered and dry silver nitrate into the bromised gelatine. The author has proved that both processes give exactly the same results. We now use, however, Lippmann's process entirely, as it simplifies the preparation of the emulsion. Only one part of gelatine is now necessary, whilst previously two were required.

The correct colour reproduction depends essentially on the correct sensitising of the plates by suitable dyes. For red sensitiveness cyanine alone comes into consideration, although it would be highly desirable to replace this uncertain dye, that keeps so badly, by a better one. Obviously have also other dyes been recommended for red sensitising; still, they are far behind cyanine in their action. We made especial experiments with the continually vaunted nigrosine B. (Beyer), and both with bathed and plates coloured with emulsion; the red sensitiveness thus obtained was extremely poor. Its behaviour was least unfavourable when 6 c. c. of an alcoholic solution of nigrosine (1:500) were added to 100 c. c. of emulsion. With increased addition of dye, the red action was still worse.

The author's trial of adding the cyanine by bathing the finished plates was not satisfactory. The solution recommended by Hubl ("Photo. Rundschau," 1899, Heft 6, p. 170) was used as follows:—

Aqueous dextrine solution, ten per cent.	400 c. c.
Alcohol	150 ,,
Borax solution (cold saturated)	20 ,,
Cyanine solution (1:500)	3 ,,

The results were still worse when the gelatine plates, like the albumen plates, were bathed in 2 c. c. of cyanine solution to 400 c. c. of water. There remains therefore nothing to do for the red sensitiveness but to add the cyanine to the emulsion. We use 3 c. c. cyanine solution (1:500) to 100 c. c. of emulsion.

For green sensitising the author had previously used erythrosine. Still, this dye is very unsuitable, because it only sensitises for yellow-green, whilst blue-green is neglected. This is particularly noticeable in taking compound colours by the preponderance of the yellow green. Considerably better results are obtained by the use of chinoline red, as used by Lippmann. The most excellent results, however, were obtained by glycinrot, to be obtained from Kinzelberger, of Prague, and which has been lately recommended by Valenta.*

Valenta took 12 to 14 c. c. of a solution of glycinrot (1:500) to every 100 c. c. of emulsion. It is not here stated whether alcoholic or aqueous solutions were used. Previously alcoholic solutions have been used, but glycinrot will not dissolve in alcohol to a strength of 1:500, whilst its solubility in water is great.

The author instituted a long series of experiments with various additions of glycinrot, and always found excellent blue-green sensitising. With compound colours, however, yellow-green always remained deficient. Finally, a combination of cyanine, erythrosine, and glycinrot (this in saturated alcoholic solution), proved to be the best for the preparation of an actually panchromatic plate. To every 100 c. c. of emulsion was used—

Alcoholic cyanine solution (1:500)	3 c. c.
,, erythrosine solution (1:500)	2 ,,
,, glycinrot (saturated)	10 ,,

With emulsions thus coloured, under normal light conditions, with spectra and compound colours, the different colours from red to violet are rendered absolutely equal.

Whether this combination of dyes would give equally satisfactory results, as regards panchromatism, with highly sensitive emulsion, we have not yet worked out. Naturally must the quantity of dyes be altered, since with Lippmann's emulsions, on account of the subsequent washing, large quantities of dye have to be taken.

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* *Photo Corresp.*, 1899, Heft, p. 559.

The large addition of alcohol (15 c. c. to 100 c. c. emulsion) appears doubtful. Experience teaches, however, that it is not only harmless, but, on the contrary, is very advantageous, since in this way extremely fine-grained and clear emulsions are obtained. A striking phenomenon is observed in the preparation of the emulsion: if the cold alcoholic dye solutions are poured into the warm emulsion, there will be an increase of temperature of at least 1.5° C. If, therefore, in the preparation of the emulsion the temperature of 40° C. is not to be overstepped, the temperature of the emulsion before the addition of the dye solutions should not be more than 38° C.

It is a well-known fact that the sensitiveness of printing papers, especially albumen, may be considerably increased by fuming them before exposure with ammonia. Similar experiments were made with gelatino-emulsion plates in order to improve their sensitiveness. The plates were kept from five to twelve hours in a box, on the bottom of which was placed an open dish with ammonia in it. It was found, however, that the sensitiveness of the plates was not in the least affected by this procedure.

A still open question is, Of what do the films of the finished Lippmann pictures consist? Every one would at once off-hand answer, "Of silver." The facts are, however, by no means so simple. In his latest publication on Lippmann's process Professor Otto Wiener* proves that the deposited particles need not be metallic silver; they may be molecular silver, or a silver compound. Wiener states "that it might be coherent metallic silver; on the other hands, when looked through, it is brown, whereas coherent silver is well known to be blue by transmitted light."

When trying to remove the surface metallic fog, which is, doubtless, the result of the action of the mercury, by bathing the plates in nitric acid the author observed that the image was extraordinarily unaffected by nitric acid. With twenty hours' immersion of the plate in dilute nitric acid the precipitate had undergone not the least change. This is the more remarkable in that the image is quickly dissolved by sodium hyposulphite and potassium cyanide. All these things make it strongly desirable to institute accurate researches upon the nature of the precipitate in Lippmann's colour pictures.

Of extreme importance are Wiener's new experiments on the influence of surface reflection on the colours,† that, when the surface reflection has been obviated by the cementing of a cover glass, the colours are more correct and more brilliant has long been known. The reason of this Wiener has explained in the clearest manner in the above-mentioned work. It is only necessary to place the finished image at an angle in a liquid which will not swell the gelatine, and which has about the same refractive index as gelatine—for instance, ether, benzole, benzine, or xylol—in order to prove without further trouble the extraordinarily favourable action of the obviating of the surface reflection. This is attained by cementing flat-glass prisms with Canada balsam on the picture. The author has observed on various grounds the differentiation of which would carry us too far, with earlier cementing experiments of this kind, a disadvantageous change of the colours. With the experiments now repeated these changes did not show; moreover, the colours gained enormously in brilliancy and truth in nature. Pure white actually only appears in the picture after the destruction of the surface reflection.

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* Wiedemann's *Annalen*, 1899, vol. lxix. p. 493.
† *Ibid.*, p. 488.

Of great influence on the resulting colours is the refractive index of that substance which is brought into immediate contact with the gelatine surface. If the refractive index is low, all the colours tend more towards the red; if it is high, they tend, on the other hand, more towards the blue and violet. There is here, therefore, a possibility of subsequently improving small colour falsities, caused by incorrect exposure of the development. The best demonstration of this behaviour is obtained if, as intermediate film between picture and glass prism, there is used first ether, with a very low refractive index, and then monobromo-naphthaline with very high index. For the final cementing of the prism Canada balsam is alone used, which, on account of its refractive index, which is somewhat too high for that of gelatine, can easily cause a shifting of the colours towards the blue and violet. If it is desired to obviate this fault, the image-bearing film must be coated, before cementing on the prism, with a film not too thin of a substance which has a lower refractive index than Canada balsam. Zapon varnish* has proved useful for this, but better still, coating the image with a thick film of gelatine. For this latter a lukewarm five per cent. solution of gelatine is poured over the picture. One always runs the danger, however, that the gelatine solution, penetrating into the image, may drive apart the thin Zenker laminæ, and the colour be finally shifted too far towards the red.

To obviate the fault of the shifting of the colours too much towards the violet by cementing with Canada balsam, the image-bearing film may also be breathed on. As regards the permanency of the image, it is, however, in any case better, instead of this, to warm the plates slightly before exposure. When using those kinds of Canada balsam with which the glass plate has to be warmed before cementing, it is absolutely necessary to warm the plate before exposure.

To obviate surface reflection, it is not sufficient to cement on to it a simple piece of glass, it must be a flat prism or glass wedge. Prisms of this kind are prepared, of excellent quality and 6.5 by 8.5 cm., by Gebr. Picht and Co., of Rathenow.†

So that the full effect of the colours may be obtained, the reflection from the back of the glass plate must also be destroyed. This is effected by coating the back with black varnish, or by cementing on to it a black glass.

In his work on Farbenphotographie durch Kornerfarben und mechanische Farbenanpassung in der Natur,‡ Otto Wiener remarks that a perfecting of Lippmann's process would be effected if it were possible to impart to the gelatine a higher refractive index by suitable additions, or to completely replace the latter with another substance of higher refractive index. The colours would not, or only very slightly, change by the change of the angle of incidence of the light; they would have the brilliancy of body colours without being them.

Experiments were made by the author in this direction during the last summer. Although they were absolutely negative, they will be briefly described, since possibly, with improved arrangements and experiments, the results may be favourable.

The author experimented with films of pure silver chloride, which, for the sodium D line, has a refractive index of 2.06. As regards the high refractive index, the advantages of such a film over gelatino-bromide of silver are very considerable. Still more advantageous would be the use of pure silver bromide, which has a refractive index of 2.25.

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* Celluloid or Pyroxyline dissolved in amyl acetate or acetone or a similar mixture.—EDITOR.

† Messrs. Penrose & Co., of Clerkenwell, also supply similar prisms in England—ED.

‡ Wiedemann's *Annalen*, vol. iv., 1895, p. 249.

The preparation of the pure silver-chloride films was effected according to the directions of Schultz-Sellack,* whose early death we must all deplore. As the author has not the essential apparatus for preparing this, Professor N. O. Witt, of the Technische Hochschule, of Charlottenburg, made some for him.

Small pieces of the silver chloride were laid on a well-cleaned glass plate, which was laid on a strong copper plate, which could be warmed by a Bunsen burner. Over the silver chloride a second glass plate was laid, so that the melting silver chloride would spread as a very thin film between the two glass plates. In order to keep the heat in better, and to prevent the cracking of the glass during the melting, which was effected at 260° C., the glass was covered with an asbestos cover.

When cold, the glass plates with the silver chloride film lying between them stuck fast to one another in an extraordinary manner. When placed in warmed concentrated nitric acid, which does not attack silver chloride itself to any marked degree, but creeps between the glasses by capillary attraction, the separation could be easily done. Instead of warm, cold nitric acid can be used, but the plates stop in it for a day.

Obviously, all this must be done in the dark room, since we are dealing with a light-sensitive body; but the sensitiveness of pure silver chloride is very little.

There is obtained in this way extremely thin, glass-clear, flexible sheets, which can be used on a glass support the same as any other photographic plate.

The exposure was made in the usual way for Lippmann's process by the aid of a mercury dark slide and spectrograph. As pure silver chloride is only sensitive for blue and violet, one ought only to expect the appearance of these colours. Development was effected with the most varied developers, and also with physical developers. These did not show, however, the trace of a single colour. The dark silver precipitate caused by development rested on the outer surface, and quickly dissolved in sodium hyposulphite. After a short immersion in hypo, the film became again glass-clear; with long immersion the whole of the silver chloride was dissolved.

THE PREPARATION OF THE LINED SCREENS FOR THE JOLY PROCESS.

Before the London Section of the Society of Chemical Industry, Mr. J. W. Hinchley, A.R.S.M., F.C.S., read a paper on the Joly process of colour photography. We are indebted to the Society's "Journal" for that portion of the paper and discussion we here reproduce. It deals with the subject of the preparation of the lined screens, and, after a brief outline of three-colour photography, proceeds:—

It is to Joly, in 1894, that we owe the step from composite colour photography to the true colour photograph. His idea, he says, referring to the Young-Helmholtz theory, "is to carry the appreciation of physiological principles still further, and divide up the plate like a hypothetical subdivision of the retina, so that all over the plate there should be minute regions uniformly distributed, wherein the sensitive silver salt is excited to become reduced to the 'photogenic' material in the same degree in which the sensations of redness, greenness, violetness, would have been actually excited in the several nerves of the

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* Poggendorf's *Annalen*, vol. cxxxix. p. 184; and vol. cxliii, p. 161.

Portrait by Fellows Willson.

TAKEN WITH A ZEISS ANASTIGMATIC LENS

Manufactured by ROSS LTD.

retina, had the image been formed upon it." The essential point of the process is a method of colour mixture which does away with optical superposition, and is at the same time extremely simple. If strips of colour sufficiently narrow be placed side by side and viewed from a suitable distance, the eye will perceive the colour due to their mixture. Acting on this, Joly combines the two sets of three screens into two, one a taking screen, and the other a viewing screen. Each consists of a glass plate carrying lines of the three colours side by side, these lines being less than 1-225th of an inch wide, and in contact with each other without overlap. By means of these screens the production of a colour photograph is comparatively a simple operation; the interceptor being placed in the lens of the camera, the plate and taking screen are arranged in the dark slide, film to film, in such a way that on exposure the lined screen filters the light before it reaches the plate. On development, a negative is obtained, recording in density of silver deposit under the three lines the degrees in which the several colours of the object have power to excite in the eye the three fundamental colour sensations. A positive printed from this negative, and adjusted in contact with a viewing screen, so that the red record line of the positive coincides with the red line of the screen, and the other lines similarly coincide, will reveal the object in its true colours. The ease and accuracy of the method are remarkable, for all the difficulties which the worker in composite colour photography has to face are overcome in the manufacture of the screen. If the taking screen in photographing a white object gives an equal density of silver deposit under each of the lines, then the colours of any object will be correct; should one of the lines be too dense, an alteration of the interceptor, by tinting it slightly to cut off the particular colour, will bring about the equality easily.

It will be readily understood from this description that the manufacture of the screen is not a simple process. The glass plates on which the lines are to be placed are thoroughly cleaned after the manner adopted in dry-plate manufacture, except that the necessity for perfectly clean glass is, if possible, greater; they are then coated with a film of gelatine, somewhat thicker than that of a dry plate; the gelatine used must be very hard, and, at the same time, as absorbent as possible; and, since the certainty of chemical action on the dyes prevents the use of antiseptics, the gelatine solution must be freshly made at as low a temperature as possible.

The operation of lining the plates is a most difficult one, and is carried out in exceptionally accurate ruling machines, ordinary drawing pens, carrying reservoirs of red, green, and violet inks, being the means of producing the lines. The pens are trailed across the plate, and, the pressure allowable being very small, the lightest pen consistent with rigidity that can be made is used.

In the early machines the spindles of the pens rested in V grooves, the lateral movement being prevented by little magnets attracting a disc on the spindle against the adjusting screw. Ruling took place in both directions of movement, each side of the pen being used alternately. It was found, however, that a great many difficulties, mechanical and photographic, could be avoided by ruling with one side of the pen, and in one direction only. In the latest machines the pens swing in jewelled bearings, rule in one direction, and are lifted on the idle or quick return stroke. Time for the absorption of each line is provided by each pen ruling a few lines in advance of that following. About one and a half minutes are required for efficient absorption. The inks are water inks, aniline dyes being used to produce the intense colours necessary and gums to give them viscosity.

After much experiment and failure, it was found that regard must be had to the following points:—

1. The hygrometric state and temperature of the air.
2. The shape of the pens and the pressure they exert on the film while ruling.
3. The viscosity of the ink at the temperature of ruling.
4. The rate of ruling.
5. The correct adjustment of the pens.
6. Absolute uniformity of conditions during ruling.

Of these the hygrometric state of the air is perhaps the most important factor, for, should the air be too dry, the ink in the pens becomes too thick and refuses to rule, and too much moisture causes difficulties from the non-drying of the ruled lines. The evaporation of the water from the ink line is negligible in comparison to its absorption by the gelatine, and since gelatine is very sensitive to changes of temperature and hygrometric state of the air, there are limits to the temperature of ruling, and at any given temperature there are definite limits of hygrometric state. At low temperature (10° or 12° C.), the dew point may be 7° or 8° below the temperature of ruling without serious consequences, but every degree above this temperature narrows the hygrometric limits considerably, until, at 19° C., the limit is between 1° and 2° C., and above this temperature ruling becomes practically impossible.

The shape of the pens is also an important factor; the nibs should slope evenly together, their inclination to each other being about 3°. The points must be semicircular in form, corresponding to the natural shape of a drop, and the diameter of the semicircle must not be more than two mm., or it becomes difficult to maintain the exact width of line. The ends of the nibs must be carefully shaped and brought to knife edges, which are finally rounded to prevent the cutting of the film, by rubbing on wash-leather. One pen will rule about 100 plates before requiring to be reset; thus its point will rub on gelatine for two miles before the wear is such as to cause bad or faulty lines. The pens are trailed across the plates, their own weight giving the pressure required to maintain a continuous line. Under ordinary conditions, they are inclined about 5° or 8°, for the pressure on the plate must not be more than one and a half grammes. If one nib is a little longer than the other, or if it touches the ridge formed on the gelatine by the previous line, a wavy line is the result, and the screen becomes useless.

It was speedily found that the quality of the screens depended on the viscosity of the ink, and the necessity arose for the measurement of this property. The inks being opaque, ordinary methods were unsuitable, and, finally, the measurement of the rate of flow through a capillary tube into a constant partial vacuum was found to provide the simplest and easiest test.

The rate of ruling will depend on the viscosity of the ink. With ink giving the best results, the speed is about seven-eighths of an inch per second.

The adjustment of the pens was a mechanical question which gave a great deal of trouble, but was solved by means which need not concern us here. The distance apart of the nibs was usually found to be about seven-eighths of the width of the line ruled. With too viscous ink, however, the nibs are found to be wider apart than the width of the line ruled, and in this case the ruling becomes very erratic.

Perhaps no more important factor in any manufacture is uniformity, and no product could suffer more from lack of this than the Joly screen. A rise in temperature of only 1° C. means at some temperatures a lowering of the viscosity of the inks to less than half their former value, with the result that the lines, on account of an increased flow of ink, widen. A correcting tendency, however, appears in the increased rate of absorption of the gelatine, so that the after-spread of the line will be less. Again, should the hygrometric state of the air alter, the absorption of the gelatine increasing or diminishing will bring about similar changes; also, while ruling, the slight drying of the ink in the pen produces a secular narrowing, so that it is necessary to commence with a wider line than would produce a perfect screen.

All these changes have their corresponding colour changes, which make it imperative to ensure absolute uniformity of conditions, for true colours are just as essential to perfect results as perfect ruling.

After the ruling of the screen is an accomplished fact, it is dried by warm air for some hours and protected by varnish. A satisfactory varnish, which would not attack the colours or dissolve them, could not be found, and, finally, a compromise was made; and, though the medium of the varnish slightly dissolved the green dye, the loss of colour, with a very concentrated varnish, was so small as to be quite inappreciable.

The manufacture of celluloid films and interceptors is a subject great enough for a single paper, and calls for no special mention at the end of this.

All methods of testing the inks for the truth of colour were found to be unsatisfactory unless applied to the ruled line, and the greatest difficulty was found in preserving uniformity in this respect; perhaps the greatest need of all was that of a green dye, whose absorption would enable the adopted curves to be imitated more closely.

All the attempts to photograph landscapes by the Joly method were, for a reason which remained mysterious for some time, failures; natural greens, illuminated out of doors, were hopelessly wrong, while the same greens photographed in a studio were reproduced correctly. The failure was proved to be due to a defect in the old spectrum plate, which was very sensitive to a band of no colour value on the border of the visual spectrum at the red end. All attempts at cutting out this band (it was transmitted by all three lines) were unsuccessful until, by accident, it was found that a trace of mercuric chloride, added to an ethyl-green solution, would do so. A method based on this was too complicated for practical work, and when the new spectrum plate appeared, was rendered unnecessary. By means of this plate correct renderings of all colours could be obtained.

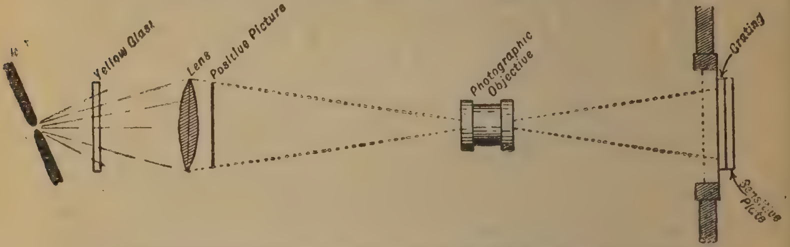
The discovery of permanent dyes, of film materials, &c., must proceed further before any great advance in this work can be expected, and we can only hope that the results of the diligent workers of the past may encourage those of the present to make colour photography still more of a practical success, rather than a laboratory experiment.

THE DIFFRACTION PROCESS OF COLOUR PHOTOGRAPHY.

At the Society of Arts, in February last, Professor R. W. Wood, of Wisconsin, read a paper on his system of colour photography with diffraction gratings. The first part of the paper consisted of a brief summary of the theoretical and practical outlines of the process. This having been fully reproduced in the Almanac of last year, from Professor Wood's former papers, we confine our present extracts from the Society of Arts paper (owning our indebtedness therefor to the Society's "Journal") to the description given of the process of printing the diffraction pictures from the positives:—

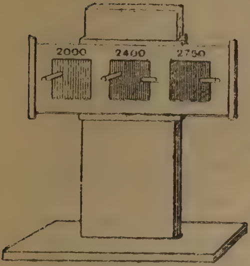
"A sheet of thin plate glass is flowed with a solution of 5 grammes of gelatine in 125 c. c. water, to which has been added 4 c. c. of a saturated solution of potassium bichromate. The plate should be drained for a few seconds, and set on a level slab to dry, after which it is cut to the required size. I have employed several different methods of building up the composite diffraction grating, which forms the colour photograph, and am at present using the following arrangement as offering the fewest difficulties.

"The three gratings are mounted behind square openings in a thin board, which slides on a horizontal support in such a way that the gratings can be brought in succession into the same position. The positive corresponding to the reds of the picture is projected by means of an arc lamp and a photographic objective on to the 2000-line grating, the ruled surface being away from the lamp. A yellow glass is placed in the path of the rays, and the bichromated plate placed with its sensitive film in contact with the ruled surface. Inasmuch as the projected image can be seen on the grating surface, it is possible to register the position of the plate by means of two or three minute ink dots on the back. The use of the yellow glass is to prevent any transfer of the grating lines until the plate is in position and pressed firmly against the grating by means of a spring. An exposure of from one to two minutes is sufficient to impress the 2000-line spacing on all portions of the plate corresponding to the clear parts of the red positive. The yellow glass is again put in place, the green positive substituted for the red, and the operation repeated, using the grating with 2400 lines to the inch, registering the plate before the exposure by means of the ink dots. The same is now done with the blue positive and the third grating, and, on washing the plate in warm water at 32° C., the colour photograph is finished. The picture once formed in this way can be very rapidly duplicated by contact printing in sunlight on the bichromated plates, copies being made as quickly and with as little trouble as ordinary blue prints.

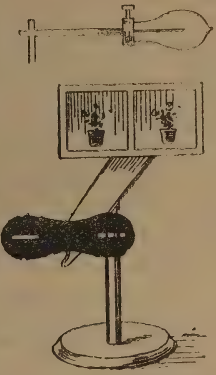


Arrangement of apparatus used in printing the first diffraction picture.

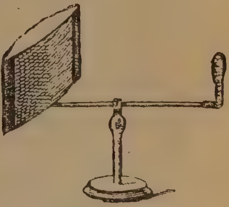
"To see these photographs in their proper colours we require a simple viewing instrument, consisting of a double convex lens on a light frame, with a small screen perforated with an aperture, mounted in its focus. The picture is placed in front of the lens, and the instrument pointed a little to one side of a gas flame or other narrow source of light. On looking through the aperture we shall see the picture in the most brilliant colours imaginable. The disadvantage of having to use but one eye led me to seek a method for viewing the pictures binocularly. The superposed spectra being formed, both to the right and left of the image of the flame thrown by the lens, if we can arrange matters so that the two points where the red, green, and blue are superposed are at the same distance apart as the eyes, we can employ both sets of spectra, and cut two peep-holes in the screen. This arrangement was found to work very well, but, owing to the varying distance between the eyes, is impracticable. Mr. Ives, of Philadelphia, suggested to me a very ingenious plan of arranging the grating lines horizontally on the picture, instead of vertically, and viewing the picture through a long, narrow, horizontal slit, instead of two apertures. Moving the eyes to the right or left would then produce no change in the colour, since the colours are arranged in a vertical instead of a horizontal band. Mr. Ives tried this method, but found it was necessary to employ two horizontal gas flames as sources of light, arranged at just the right distance apart, which is an undesirable complication. I have recently overcome this difficulty by using a viewing stand with two square lenses, mounted side by side, and a double or stereoscopic diffraction picture, which is viewed through a horizontal slit, in front of which are mounted two thin prisms for combining the pictures. This is by far the most satisfactory form of stand, for we can not only use both eyes, but see the pictures in full stereoscopic relief.



Grating support used in making diffraction photographs.



Position of lamp and stand for viewing stereoscopic pictures.



Viewing apparatus.

"Very promising results have already been obtained, though the distribution of colour is not yet satisfactory. The defects in the pictures thus far made are largely due to the very imperfect gratings that I have had to work with. The spacing of the gratings is not quite uniform, and they have, in consequence, a ribbed or corrugated appearance when placed in front of the lens. These corrugations show in all of the pictures, and are very detrimental to proper synthesis of the colours. A set of perfect gratings has just been ruled on one of Professor Rowland's engines in Baltimore, but, unfortunately, they were only finished on the day of my departure from America, and I have not had an opportunity of trying them.

"A grating, with 2000 or more lines to the inch, ruled on a first-class engine such as the one at Baltimore, illuminates uniformly when placed before the lens, and is as structureless as a piece of stained glass. As I have said before, the lines visible in most of the pictures that I am at present able to show are due to errors of ruling, the grating lines themselves being, of course, quite invisible.

"There are other ways in which the process may be modified. We may, for example, combine the diffraction method with that invented by Dr. Joly. It is found impracticable to rule coloured lines to the number of more than three of four hundred to the inch; but we may rule as many as 1400 grating lines to the inch, and by arranging the engine so that it will rule at a variable rate, first a few lines at such a distance apart as to give red, then a few a little closer together, so as to give green, then a few still closer together giving blue, we could produce a Joly plate which would appear absolutely structureless. It, of course, could not be used in the same way. This plate, once ruled, could be multiplied indefinitely by contact printing; and diffraction pictures could be made from it in several different ways; but, as I have as yet made no experiments along these lines, I shall not take the time of the Society in guessing at what may be done. It has been reported in some of the photographic journals that Mr. Thorp, of Manchester, has made and exhibited diffraction pictures showing all the colours of nature by employing a single grating. I must confess that I am at a loss to know how he has accomplished this, unless he had anticipated me and ruled a grating of variable spacing. If he is with us to-night, I know we shall be very glad to hear from him.

"There are still some difficulties to be overcome, and I do not feel sure that bichromated gelatine forms the best film for receiving the impression of the lines. It is interesting to note the theoretical possibility of producing one of these diffraction pictures directly in the camera, by bringing three diffraction gratings, ruled or photographed on three coloured screens, in succession in contact with the film of a fine-grained plate. I have done this already with a single grating, but have not yet attempted the use of all three. Special plates would, of course be required.

"Another peculiarity is that all distinction between positives and negatives disappears. A diffraction picture printed from another is identical with it both as to light and shade, and colour distribution."

LANTERN RADIANTS.

The following paper by Mr. R. R. Beard, the well-known optical lantern expert, was read before the Photographic Club in December, 1899. The lengthy experience and practical ability of the author render his paper exceedingly valuable:—

The radiants which I bring before your notice are only those of a useful and commercial nature, as I do not think that a description of obsolete apparatus would serve any good purpose. Those to which I shall allude are the petroleum lamp, acetylene, the incandescent Welsbach mantle, limelight, and the incandescent and arc electric lamps.

Petroleum.—The first practical lamp was that introduced by our American friend, Mr. Marcy, of Philadelphia, who worked out a form of lamp which, up to the present day, is embodied in nearly every petroleum lamp and lantern. The "Sciopticon" is the name of the lantern, and it was introduced into England by Mr. Woodbury. It has two flat wicks about two inches wide and parallel to each other, having an air space between them. The edges of the wicks are placed towards the condenser. A very good light is given off, and the lamp is about the coolest oil lamp working.

Other lamps have been introduced, all adhering to the same size of wick, but having, instead of two, as many as three, four, and even five wicks. Of the three-wick lamps, Newton's Refulgent is the best, in my opinion. It was introduced to obviate the dark space which was always noticeable with the two-wick lamp, owing to the dividing space. Stock's patent lamp, a four-wick lamp, cannot be beaten for light-giving properties, construction, and working, amongst its kind. It differs from the old form, both in the body, or combustion chamber, and in the chimney. The combustion chamber is formed so that the incoming air is brought into contact with the flame in such a manner as to produce, in conjunction with it, the best result, and is provided with an adjustable reflector for collecting and bringing as much light as possible into focus. Provision is made for the extension of the chimney mechanically. This is very important in practice, as on first lighting a lamp everything is cool, and the evaporation of the oil is much less than when the whole lamp is heated. Hence one must either turn the wicks down or gradually lengthen the chimney as the lamp gets heated. The latter is the better course. The light is increased, and one has only a single knob to turn in the chimney, while to tamper with the wicks, which are four in number, each requiring nice adjustment, takes a considerable time, with very often a poor result. The chief point in favour of petroleum lamps is that petroleum can be purchased nearly everywhere, and it is always ready for use. There is little or no danger, and it gives a very fair light with the average commercial slide. Five-wick lamps were introduced, but were found difficult to manage. The combustion was bad, and very great heat was given out.

Acetylene.—This gas gives a very white and intense light compared with petroleum, although I think the quantity is about equal. It is generated with little trouble, and is easy to manipulate. There are many very good generators now obtainable, notably those of Messrs. Thorn & Hoddle, the Abingdon Safety Generator Company, and the Bon-Accord Acetylene Gas Company. Each of them has features of its own, but all are suitable for lantern purposes. Mr. W. Tylar, of Birmingham, has specially constructed an exceedingly portable form, which takes the place of the petroleum lamp and fits in the lantern body, taking up no more space, and reported to give satisfactory results. There are, however, disadvantages about acetylene, and one is the corroding of the burners. Great improvements in these have lately been made, and without doubt this fault will soon be overcome with the purification of the gas and other improvements which are being effected in the generators. Another difficulty is that, unless special care be taken to make all joints sound, small leakages will soon make themselves known by the strong and peculiar odour of the gas. Acetylene is, like all other hydrocarbons, perfectly safe until oxygen combines with it, but in its simple form may be considered without danger.

The Welsbach mantle has been before this Club upon more than one occasion. I have been experimenting with it to see what its real value as a radiant for lantern work might be, but up to the present can only look upon it as a convenient radiant for places such as drawing-rooms, with a disc of six to nine feet. I have also put the mantle in lantern for enlarging work, where it has given every satisfaction.

I have recently been experimenting, in conjunction with Mr. Henry Howell, of the Welsbach Company, and have brought up the burner constructed by him to show you. To obtain better pressure I have introduced a cylinder of condensed gas, which gives a pressure much higher than can be had from the house supply. Unfortunately, one cannot yet rely upon the compressed gas, owing to the iron which it contains depositing upon combustion upon the mantle, quickly ruining the latter's incandescent properties.

With a cylinder of coal gas kept standing for three months, the mantle will go in a few minutes. House gas can be used with a mantle for an average of one thousand hours. We were promised stronger mantles, which would stand the increased pressure of the compressed gas, but I find that there is an almost daily shrinkage of the mantle against the burner, and sooner or later it splits. It should be seen that no flame is proceeding above the mantle, turning down the gas until this is remedied. Its illumination is about equal to that of the oil lamp, but its drawback is that its area is so great.

Limelight is obtained by the incandescence of a white-hot lime. There are several forms of apparatus with which to bring about this object, and one of the most simple is a jet named the Safety Jet, or Blow-through Jet. For the reason for the name "Safety" we must go back to the early days, when the gas was stored in bags, and there was little to prevent the gases from becoming mixed. To obviate this, the tubes conveying the gases were entirely independent, one of the other, the two gases issuing from two separate orifices, the house gas from the larger orifice and the oxygen from the smaller, the latter blowing through the flame of the house gas. Such a jet is upon the table. I have also another jet in which the orifices, instead of being separated, as in the last case, are connected by a Y piece. This form ensures the issue of both gases at the same angle, the oxygen nipple being in the centre of the coal-gas flame. By this means one gets a more concentrated flame, and, I think, as a rule, a little better result than that given by the former. The best distance for the lime for burners of this description is from ½ in. to ⅝ in., or, better still, for the operator to look at the reflection of the lime in the condenser and to draw the lime to and from the burner until he sees no black spot. There are other forms of blow-through jets, but I shall speak of those under the heading of injector jets.

The injector jet is a jet in which the gas, at a high pressure, is made to force or inject gas at a lower pressure. As an instance, I take the form of jet where the Y piece connects the two tubes, and by inserting the nozzle in the Y we shall at once form a simple injector; but, in practice, this form of jet does not give the best of results. But if the principle is employed in a different manner, as for instance, in the Manchester Oxygen Co.'s jet before you, the principle of injection is more fully developed.

I have installed in a London music hall this form of jet for stage lighting, giving the utmost satisfaction, and, although they were at first suspected, they have been no trouble whatever, and are now running perhaps better than at first, owing to the greater confidence and practice of the operators.

In using this jet for biunial lanterns there is a difficulty in dissolving unless a very strong pressure of house gas is obtainable. The difficulty is due to the snapping or small explosions in the mixing chamber in dissolving. I attribute this to the high pressure of the oxygen and the low pressure of the house gas in the tubes from the burners to the dissolving tap. As an instance, say that a tube eight feet long filled at normal pressure with coal gas, and another tube eight feet long filled with oxygen at an atmosphere pressure, you will have two volumes of oxygen to one of coal gas, and this is exactly what you get in the ejector jet from the dissolver. You cut off the supply in these proportions, hence the oxygen expands to form an explosive mixture in the chamber of the jet and explodes.

In working this jet I find it quite different to the blow-through jet. In the blow-through jet more coal gas is wanted, but with the injector jet you usually have too much, and it requires cutting off. In turning off the jet it is always best to turn on the house-gas tap full, then turn off the oxygen, and finally turn off the house gas. I have no doubt that, if a dissolver were made to work on this principle, it would remedy the failing I have described. While upon the subject of injector jets, I have here a separate injector with which any mixed jet can be used. It is only necessary to put a larger nipple upon the jet, and you can use your house gas.

The use of the injector in conjunction with the cylinder of coal gas and the house gas will be found very useful for increasing the pressure of the house gas. Instead of using compressed gas altogether, only a little need be used, and the higher pressure obtained at a minimum of expense.

Electric Light.—My experience has been entirely with the direct current arc light. In my hands it has been very simple and easy to work, and, with a lamp under perfect control and with the carbon holders both insulated, there should be little trouble. I think that electricians are likely to be too lavish in the quantity of current for lantern projection, thinking, doubtless, that what suits the kinematograph will suit the ordinary lantern. Sixty volts is what will usually be found best suited for the purpose.

THE HISTORY OF OPTICAL GLASS.

[Translated from "The Theory and History of the Photographic Objective" by Dr. M. Von Rohr.]

The manufacture of optical glass could only attain importance when, in consequence of the development of optics, telescopic objectives of greater dimensions were found to be a necessity. The most important step in this direction was the achromatising of telescopic objectives, in which John Dollond succeeded in the year 1757. The two kinds of glass, crown and flint, which were now to be made in larger discs, offered great and separate difficulties in the art of melting, in so far as, towards the end of the last century, pieces of somewhat greater dimensions were obtainable from crown, but not from flint, glass. We may observe that the melting of optical glass differed in no way from that of ordinary glass, the whole proceeding consisting essentially in selecting the pieces fit for optical instruments from among those prepared for other trade purposes. Thus does G. Bontemps describe—and, in this instance, free from prejudice—the attempts made by the glass manufacturer, D'Artigues, who supplied material to the optician, R. Cauchois.

By this method, however, but very small discs, 8-11 cm. (3 to 4 inches), were produced, and even these could not be guaranteed. The difficulties to be overcome in the production of comparatively thicker pieces as, for instance, the Chevalier prisms, have already been treated of in a former chapter.

The first who directed his attention to the making of specially optical, or, more correctly, flint glass, and thus paved the way for the necessary differentiation in the melting industry, was the watch-maker, Pierre Louis Guinand (born, 1748; died, February 13, 1824), of les Brenets, a little place on the French frontier, in the present canton of Neufchatel. How this man happened to hit upon the idea of glass-melting, which lay so far out of his own department, and who, according to G. Bontemps, carried it on as a clever amateur without any technical knowledge, it is impossible to say. His attempts, which extend back to the year 1775, did not, however, prove very successful, as may be inferred from the communication of the optician, Rochette, and the astronomer, J. de Lalande, contained in a letter of Aime Guinand, the son of P. L. Guinand.

According to this same source, negotiations began in 1804 with the

Bavarian national economist, J. Utzschneider, by whom P. L. Guinand was invited to send samples of glass to Munich for examination, J. Utzschneider being in want of a capable technologist for the proposed enlargement of the Liebherr works, which he intended developing into a mathematical mechanical institute. Whatever the result of the examination was has remained unknown. In any case, a meeting of the two parties was arranged, and took place in Aarau between J. Utzschneider and the two Guinands, the former giving an order in January, 1805, for a sample melting of flint glass at his own expense. The result of the examination of this and other glass ended in the removal, in September, 1805, of Guinand to Benediktbeuren. In the two accounts to hand we meet with a contradiction in so far as J. Utzschneider, in his obituary on J. Fraunhofer, represents P. L. Guinand as a melter of limited ability, on whose engagement he had not definitely decided at the time of the meeting in Aarau. According to A. Guinand's account, his father removal to Benediktbeuren took place entirely at J. Utzschneider's personal solicitations. However this may be, it was only in February, 1807, that a contract, for the space of ten years, was closed with P. L. Guinand, by which he was to receive a fixed salary of 1600 florins in gold,* and to live free of rent.

The interval, from the autumn of 1855, was filled up in the building of a glass manufactory and the preparation of preliminary meltings. By the terms of his agreement, P. L. Guinand had bound himself over to disclose his secret to J. Utzschneider, and to any person named by the latter. This secret, no doubt, consisted in the stirring of the crucible with a rod composed of crucible clay, though on this point we can give no positive affirmation, this artifice being looked upon as a trade secret, and no account of P. L. Guinand's acquirements, or of the improvements introduced by J. Fraunhofer appearing ever to have been published separately. The meltings at first carried on in J. Utzschneider's presence presented two deficiencies; the glass was full of striæ and the refractive indices of the different pieces varied according to their position in the pot. Only by using carefully selected crown and flint pieces was it possible to supply the necessary objectives to measuring instruments, which were ready-made as far as the brasswork was concerned. We are therefore not surprised that this result did not come up to J. Utzschneider's expectations.

Meanwhile (in 1807) J. Utzschneider being again called into the service of the State, and no longer able to devote his whole attention to the glass manufactory, initiated J. Fraunhofer into the secret, and even intrusted him, in September, 1811, with the task of producing flint glass in conjunction with P. L. Guinand. At the second meeting J. Fraunhofer obtained glass free from striæ and homogeneous through the entire pot, without, however, securing complete certainty, for later meltings were again unsuccessful. It was only two years afterwards he discovered that, in order to guarantee good quality, he must use larger pots—of four, instead of two hundredweight capacity.

Some time later (on December 6, 1813), P. L. Guinand gave notice to leave, and in the beginning of the next year, after a sojourn of eight and a half years, left Benediktbeuren, under the stipulation of abstaining from any active part in glass manufacture on payment of an annual compensation of 800 florins.†

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* Notwithstanding all my endeavours, I have been unable to ascertain the value of the sum in modern money, the standard of coinage in South Germany at that time being apparently unknown.

† The value of this sum was just as impossible to ascertain as that of the salary. Not even the proportion between the florin proper and the florin in gold—neither one nor the other then being a coin, but a simple unit for calculation—could be established.

According to concurring accounts, he undertook the management of a new glass manufactory in 1816, thereby losing his compensation, but making an offer, as we are informed by J. Utzschneider, to return to Beneditkbeuren, an offer, however, which was not accepted. In his glass works he produced, according to his son's testimony, discs for objectives of 33 and 35 cm. (13 and 13 3-7 inches) diameter, which were bought by N. J. Lerebours and R. Cauchois. Later on he entered into correspondence with the London Astronomical Society, and also with the French Government; the negotiations, however, fell through, and P. L. Guinand died on February 13, 1824.

In Benediktbeuren J. Fraunhofer continued to work at the production of optical glass, and, according to J. Utzschneider, obtained better glass, and with more certain results, than P. L. Guinand had been able to do in 1814.

The largest telescope completed under J. Fraunhofer's supervision had a diameter of lens of 24.4 cm. (9.6 inches). The objective for the Bogenhausen telescope, with a diameter of 28.4 cm. (11.2 inches), was taken in hand during his lifetime, and the Merz firm, working upon his tested methods, found it possible later on to produce discs for objectives with an aperture of from 38.0 cm. (15 inches) to 43.4 cm. (17.1 inches).

But it would scarcely be fair to speak only of these successes concerning ordinary glass manufacture, J. Fraunhofer taking a far broader view of his task. Not content with having mastered the purely technical difficulties of ordinary glass-making, he originated the important idea of examining the influence exerted by the different components on the qualities of the ready-made glass.

In the first place, he tried to find out the connection between the composition of the glasses and their liability to tarnish; and, in the second, he undertook the far more important task of systematically ascertaining the connection between composition and optical qualities.

J. FRAUNHOFER'S GLASSES.

Kinds of Glass.	Refractive index for D.	Medium dispersion C to F.	$\nu = \frac{n-1}{\Delta n}$	Partial Dispersion.		
				B to D.	D to F.	F to G.
Crown glass No. 13...	1·5280	0·00904	58·4	0·00367 0·406	0·00636 0·703	0·00557 0·616
Crown glass No. 9 ...	1·5296	0·00920	57·6	0·00376 0·409	0·00647 0·703	0·00561 0·610
Crown glass Lit. M. (probably containing kali)...............	1·5591	0·01081	51·7	0·00430 0·398	0·00767 0·710	0·00679 0·628
Flint glass No. 3......	1·6085	0·01624	37·5	0·00645 0·397	0·01155 0·711	0·01073 0·661
Flint glass No. 30 ...	1·6306	1·01799	35·0	0·00702 0·390	0·01288 0·716	0·01194 0·664
Flint glass No. 23 ...	1·6337	0·01831	34·6	0·00709 0·387	0·01310 0·716	0·01208 0·660
Flint glass No. 13 (probably borosilicate flint)	1·6359	0·01858	34·2	0·00729 0·392	0·01322 0·712	0·01203 0·648

In this aim, too, J. Fraunhofer was quite original, inasmuch as previously to him no one had ever been able to give the optical properties of the different glasses in exact figures. It was through his method of using the dark lines on the spectrum that refractive index and dispersion could be correctly measured, and it was due to the same method that the disproportionate increase of the dispersion in crown and flint glasses became a certainty. Being himself a practical optician, he was fully conscious of the importance of glasses with proportionate increase, and, aware of this quality in combinations formed of a glass and a certain liquid, he cherished the hope of melting glass pairs superior in this respect to the old crown and flint. In order to give an idea of his results, I subjoin a table of his glasses in the form afterwards used by E. Abbe and O. Schott.*

The pair best agreeing was Crown Lit. M. and Flint No. 13. The reason for giving up these promising meltings is very likely to be found in their fatal liability to tarnish.

To these promising attempts—the production of the new glasses in larger meltings not having, as it seems, been arrived at—the death of J. Fraunhofer in 1826 was fatal; they fell into oblivion. Neither J. Utzschneider nor G. Merz and F. J. Mahler were capable as yet of developing the work of the gifted deceased, and the process of glass-making remained simply in the state to which Fraunhofer had brought it for regular manufacture.

Before we come to speak of the further development of the art of glass-making, it will be advisable to cast a look back on the merits of the two above-mentioned men, which seems all the more necessary as the accounts to hand evince a great spirit of partisanship, A. Guinand and G. Bontemps taking part for P. L. Guinand, and J. Utzschneider siding with J. Fraunhofer. Added to this is the objectionable habit, so often to be met with in men of different nationality, that he who can most detract from the merits of his foreign opponent is looked upon as the better patriot. In this A. Guinand, anxious to ascribe the world-wide fame of J. Fraunhofer's Optical Institution to the labours of his father, goes to the extreme. However human this may be, we must most distinctly declare that the results of the co-operation of several men can by no means be attributed to one alone. We shall be doing justice to P. L. Guinand when we ascribe to him the very happy idea of the suitable stirring rod, but the development of the process by which the success of the melting might be reckoned upon with some certainty appears essentially due to J. Fraunhofer; in any case, A. Guinand does not credit his father with this ability. Concerning, however, the plan of methodically improving glass in respect to the lessening of the oxidising influences and the removal of the secondary spectrum, this, in so far as it succeeded at all, must be ascribed to J. Fraunhofer alone.

Coming now to the further development of the manufacture of glass, the scientific treatment, as already mentioned, disappeared with J. Fraunhofer's death. The Optical Institution carried on the technical work as before, providing glass, however, for its own needs or those of the Merz firm only, and appears not to have remained behind the foreign productions. How great an importance we must attach to J. Utzschneider's personal influence may be inferred from the fact mentioned by E. Voit that a competitive manufactory was founded in the very year of J. Utzschneider's death.

The latter died on January 31, 1840, from the results of an accident, and in the same year the Munich banker, Ruedorfer, in Kohlgrub, near Murnau, founded an Optical Institute, with glass works, in which the meltings were carried on under the supervision of a workman formerly in J. Fraunhofer's employment. This Institute did not remain long in existence, owing to the want of scientific assistance required for the computation of the lenses to be ground from the ready-made glass. The glass produced there was made use of, up to the fifties, by the Munich optician, Baader.

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* To readers desirous of further information, we beg to refer to Mr. T. R. Dallmeyer's able paper in THE BRITISH JOURNAL OF PHOTOGRAPHY, 1890, p. 293.

Here we may still mention the attempts of the mechanic, Korner, in Jena, who, under the patronage of the Grand Duke of Saxe-Weimar, tried to melt flint glass between the years 1826-46; but his endeavours, which were directed towards the melting of ordinary flint glass only, remained without result.

Also C. A. Steinheil, as A. Safarik, on M. Perty's authority, reports, had set himself the problem of melting glasses with proportionate increase of the dispersion. For this purpose he himself had spectrometrically examined the different sorts of optical glass, and succeeded in interesting the celebrated J. Liebig to take in hand the chemical analysis of the samples. He was hoping by simple calculation to find out the proportion of the components in order to arrive, within certain limits, at the prescribed variation of the dispersive power; but, concerning these attempts, nothing has been published.

Georg Merz and, after his death in 1867, his son, Sigmund, continued to a certain extent J. Fraunhofer's attempts to melt glasses with proportionate increase of the dispersion. S. Merz's meltings of 1868 showed the influence of the percentage of lead on the optical properties, and in 1882 his published account gave notice of the result that proportionate dispersion could be obtained by infusing the right amount of lead.

This is all that is known concerning the art of glass-melting in Germany in earlier days. Nearly everything relates to J. Fraunhofer or to his successors or zealous imitators. Manufactories for the making of optical glass only, which had nothing to do with the grinding of the lenses, appear nowhere to have been in existence.

Far different was the fate of J. Fraunhofer's art in foreign countries, and first of all in the French-speaking domain. After the death of P. L. Guinand the secret remained in the possession of his two sons, one of whom, probably the elder, was the above-mentioned Aime. The two separated, the elder becoming proprietor of a glass manufactory in the neighbourhood of Neufchatel, which was carried on later by his successor, Theodore Daguet, in Solothurn.

The younger son entered into connection with G. Bontemps (one of the Directors of the glass manufactory of Choisy-le-Roy), and the Parisian optician, N. J. Lerebours, working in conjunction with them according to his father's method of process; but, the information he imparted being found insufficient, the connection was dissolved. Upon this, according to Sh. Muspratt's statement, the technical director of the glass works, Thibeaudeau, was drawn into consultation, and at last, in the year 1829, their joint efforts resulted in the production of glass discs free from defects, of from 32.5 to 38 cm. (13 to 15 inches) diameter. From this time forth, relying on G. Bontemps' account, we are able to speak of a regular manufacture of optical glass in France. This was taken up first by G. Bontemps, and then by P. L. Guinand's youngest son, who, upon his death in 1851, was again succeeded first by his son-in-law, and afterwards by his grandson, Ed. Feil. The Guinand method of procedure was published in 1840, almost contemporarily by G. Bontemps and the younger Guinand. Very probably the information given by Ch. Fabre (1892), "Guinand had introduced boracic acid into the glass in 1842," refers to the latter. But the kind of glass thus obtained does not appear to have been durable.

Later on, in 1848, G. Bontemps, finding himself politically compromised, and being obliged to resign his position, accepted an invitation from the firm of Chance Brothers to go to Birmingham. His removal thence now carried the art of glass-making into England, and the firm acquired a great reputation for optical glass; as a matter of fact, the growth on foreign ground of the Guinand-Fraunhofer art was very favourable in respect to its technical excellence, and we may safely say that photographic objectives, up to the more modern times, were exclusively prepared from French or English material.

The great success which during the period mentioned had attended the technical manufacture of glass in Benediktbeuren and the brilliant achievements of J. Fraunhofer in telescopic optics, had become known to a very wide circle, and excited general sensation. This was all the more natural, the production of flint glass having been looked upon as a trade secret. In 1824 the London Astronomical Society appointed a commission to conduct an inquiry into the manufacture of flint glass. This commission, whose members included J. F. W. Herschel, M. Faraday, G. Dollond, and P. M. Roget, arrived at the conclusion that the improvements necessary were rather of a mechanical than chemical nature, and in particular that freedom from striæ could only be brought about by constant agitation of the mixture.

The leading spirit of this commission, however, M. Faraday, did not confine himself to this simply theoretical discovery, but busied himself, both in his own laboratory and in the glass manufactory, with the practical solution of the question, and, by making some changes in the chemical composition, came upon glass easily fusible, which therefore offered greater facilities for the constant agitation operation. This substance, of remarkable limpidity, was known under the name of Faraday's heavy glass, and proved very important in experiments connected with the polarisation of light by magnetic action, and is composed, according to Muspratt, of the following ingredients:—

Protoxide of lead	104	parts.
Silicate of lead	24	,,
Dry boracic acid	25	,,

The next improvement, made independently of the Guinand-Fraunhofer school, took place in France by the manufacturer, Maes, in Clichy, and was the production of zinc crown. The exact date of the discovery is unknown; its first appearance seems to have been at the London Exhibition in 1851, where it was distinguished by a Council medal. It contained oxide of zinc and a certain percentage of borax or boracic acid, being colourless and homogeneous in the mass. From Ch. Chevalier's communications, we learn that this material was used for his photographic objectives. At the Exhibition more weight had been laid on the applicability of the new materials to telescopic objectives, and two plates of 11.4 cm. (4½ in.) and 17.8 cm. (7 in.), colourless and free from striæ, were exposed for show.

Very interesting is the abstract given by Sh. Muspratt from the report of the Council Jury on Optical Glasses. In this abstract great attention is drawn to the importance which the attempt of Maes for the removal of the secondary spectrum has when zinc crown is used in the place of flint glass, whilst the place of the crown is taken by a hypothetic glass "in which fluorine enters as a distinguishing ingredient, in combination with silica, aluminium, or other materials." Such hypothetic glasses, colourless and homogeneous, had been made in small quantities. Since this report of the 1851 jury nothing further has been heard of the matter, and it does not appear that this initiative of trying to obtain objectives with diminished secondary spectrum has been followed up.

After the Maes procedure, which seems to have been carried out on a large scale, the regular production of this glass being mentioned even as recently as 1856, only one new kind of glass, of French origin, is known to me, and of which notice is made in the year 1867. This glass was melted by the Parisian glass manufacturer, Lamy; it was a heavy thallium flint glass of specific gravity, 4.18, and a refractive index, nD 1.673 (nB 1.661; nH 1.710), and was of a yellow colour. Whether the same was ever brought into use, I am not able to say.

Thus we see that at the time when the production of optical glasses was in a flourishing condition, both in France and in England, the consciousness of the importance of new glasses had not been lying dormant. In France some such did appear, but it does not seem that the attempts were carried on in any systematic manner.

Not long after the death of J. Fraunhofer, an English clergyman, William Venables Vernon Harcourt (b. June, 1789; d. April, 1871), began attempts in glass-making. At first he could make but few meltings, owing to the hindrances which always offer themselves to experimental laboratory meltings. A fresh impulse, however, was given to his efforts by G. G. Stokes, whose acquaintance he made on the occasion of the 1862 meeting of the British Association at Cambridge. This savant had busied himself with researches on fluorescence, and therefore evinced great interest in W. V. V. Harcourt's work. Inquiries on fluorescence, which appear to have been taken into consideration were, however, soon dismissed in consequence of the greater importance attached to the examination of the spectrum. From this time attempts were systematically carried on, and in 166 different meltings a series of very different compounds was put to the test, in order to ascertain their influence on the increase of the dispersion through the different regions of the spectrum. Doubtless, it was all the more difficult to determine this influence as W. V. V. Harcourt had not been successful in producing the smaller samples homogeneous, and therefore the striæ contained in the prisms ground from the samples made exact measurements impossible. Nevertheless, placing reliance on their measurements, W. V. V. Harcourt and G. G. Stokes were in a position to lay down certain rules, for instance, that titanic acid lengthens the blue, whereas boracic acid extends the red end of the spectrum. The principal aim of their researches was J. Fraunhofer's old object of melting glass suitable for removing the secondary spectrum; they considered they had nearly attained their aim and produced—according to A. Safarik—two discs of titanic glass and two of terborate of 7.6 cm. (3 in.) diameter, which were destined for a telescopic objective free from secondary spectrum. In grinding the lenses it was found necessary to cast aside one of the titanic discs and to grind in its stead a lens of ordinary crown glass. The objective thus composed was not faultless, but proved that it was possible to get rid of the secondary spectrum.

W. V. V. Harcourt's death, in April, 1871, appears to have put an end to these efforts for production of new glasses.

The results published by G. G. Stokes underwent a critique by S. Czapski, of which I take advantage in the following. The English savants had correctly recognised the specific influence of boracic acid, whereas they were in error respecting their statement concerning titanic acid. On account of the inconvenience of working with silicates, arising from the difficulty of fusion and the pasty character of the fused glasses, W. V. V. Harcourt's experiments were chiefly carried on with phosphates, the influence of which were looked upon as that of titanic acid.

W. V. V. Harcourt's work was not taken up in England to any great degree; one attempt at titanic glass made by J. Hopkinson in the glass works of Messrs. Chance Brothers was unsuccessful, because, as we have already remarked, the titanic acid does not possess the specific influence ascribed to it.

That similar experiments were not further carried on either by the English firm or the French Swiss manufacturers, notwithstanding the publications of G. G. Stokes lay—as E. Abbe has pointed out—apparently in the fact that on the one side the risk was very great, and, on the other hand, the production of optical glass had become, so to speak, almost a monopoly, and therefore no absolute necessity existed for these firms to put themselves to any extraordinary trouble.

The necessity of applying perfectly new glasses, of which the principal virtue was not the proportionate increase of dispersion in crown and flint glass, but a new relation between the medium refraction and the medium dispersion, was, as far as the photographic objective was concerned, pointed out by L. Seidel in 1856, and by J. Petzval in 1857, yet the remarks of these two men seem to have been passed over without attracting any attention. In 1878 E. Abbe laid great stress upon the importance of new glasses for microscopic objectives, further improvements with the old kinds having been found impossible. This necessity in microscopic, as well as the long-felt want in telescopic optics, became paramount, and turned the attention afresh of wider circles to this question. Later on, the attempts undertaken at a previous period by H. Schroeder and A. Safarik were also made public.

The first-named had begun to melt magnesia crown glass in conjunction with Th. Daguet, of Solothurn, and, according to H. Schroeder, these attempts had taken place before the year 1870.

A. Safarik had worked with the aim of producing glasses with proportional increase of the dispersion, and especially after the method pointed out by the 1851 jury, in order to discover new glasses which could be used as crown glasses in combination with the old crowns, the latter to take the place of the flint components. But these attempts brought no results, owing to the insurmountable difficulties attached to the meltings of silicate in the laboratory.

An extensive change, however, took place when Otto Schott, a clever technical chemist, intimately acquainted, through serious study and family tradition, with the art of ordinary glass-making, and attracted by the report of E. Abbe on the necessity for new glasses, entered into connection with the latter. The joint work of these two men began in 1881, in accordance with the plan agreed upon between them, to study minutely all the chemical elements which can be combined in any form as an amorphous flux, with regard to their influence, both on refractive index and dispersion. O. Schott undertook the experiments on a very small scale at Witten, in Westphalia, where he resided at the time, whilst the optical examination of the results by means of spectrometric measurements was made by E. Abbe, assisted by P. Riedel In the course of the first year certain facts were elicited on the specific effect of different substances, and it was decided to continue the work on the chemico-optical principles already arrived at, and to systematically combine glass fluxes, the properties of which should satisfy the optical requirements as far as possible, and yet possess their usual physical characters, such as hardness, constancy of composition, and freedom from colour. To this intent O. Schott, in the spring of 1882, removed to Jena, where experimental meltings were made on the larger scale required in quantities of about 10 kilos (22½ pounds).

In these experiments two independent points were kept in view. The first concerned the problem prosecuted by J. Fraunhofer and his successors, of the proportional increase of the dispersion through all the regions of the spectrum, in order to gain a more perfect degree of achromatism, and thus lessen or destroy the secondary spectrum.

The second problem, of no less importance, was that of attaining great variation in the two chief constants of optical glass, *i.e.*, the refractive index and the medium dispersion.

The old silicate glasses could, in consequence of the uniformity of their chemical composition, as far as their optical qualities were concerned, all be represented by a single series. They exhibited, with some few and practically unimportant exceptions, a steady increase of the medium dispersion in the same proportion as the increase of the medium refractive index. The systematic use of a larger number of chemical elements made it possible to put at the optician's disposal glasses of the same refractive index but different in the value of the medium dispersion, or other glasses in which the medium dispersion was constant, whereas the refractive indices varied. The solution of this problem being successfully accomplished, the optician was in a position to satisfy L. Seidel's condition, and to use, for the purpose of photo-optics, crown glasses with a high refractive index.

The second stage of the work, which had begun in the spring of 1882, was the founding and setting up of a laboratory, in the year 1886, by O. Schott, E. Abbe, and C. and R. Zeiss, known as the Glass Manufactory for Optical Purposes of Schott & Gen., Jena, Germany. The building of these glass works was completed in 1884, and a liberal subvention on the part of the Prussian Government contributed in no small degree to the carrying out on a large scale of the first very expensive experiments for the fabrication of glass in large masses.

In quite recent times the example given in Jena has been effectively followed in Paris, where Ed. Mantois, the successor of Ed. Feil, apparently in the year 1893-4, took up the fabrication of the new glasses. Judging from reports by Ch. Fabre and E. Wallon, it appears as if attempts with new glasses had already been made towards the year 1880, but further particulars on the results obtained at that time have not been given in those references.

FLUID SCREENS AND THEIR APPLICATION TO ORTHOCHROMATIC PHOTOGRAPHY.

A lecture given by M. Alexander Popowitzky before the V. Section of the Imperial Russian Technical Association, St. Petersburg.

[Translated from the *Photographische Correspondenz.*]

In September 1898 a very interesting photographic treatise by Dr. Nagel, lecturer for the Chair of Physiology at Freiburg-i-B., was published in the "Biologisches Centralblatt," the subject being "Concerning Fluid Colour-Screens."

A colour screen is understood to be any transparent coloured medium which has the power to decompose a pencil of mixed white light. One portion of the rays is cut off by the colour filter and the other portion is transmitted. Filters of this kind have been used in photography for a considerable time. Red and yellow glass being absorbers of the chemically active light rays enable the photographer to illuminate his dark room so that he can carry out complicated manipulations with light sensitive substances without their being affected. The discovery of orthochromatic, photographic plates, sensitive to those rays which had been regarded as chemically inactive (non-actinic)—the red, the yellow, and the green—brought about a further extension of the use of colour filters. A want was soon felt for screens that transmitted monochromatic light only, that is to say, rays of a particular colour. In most cases it is no easy task to secure monochromatic rays by decomposing light with a prism, and special difficulties arise in the application of the process, if it is required to illuminate a comparatively large surface with monochromatic light. For the same reason, biologists were also compelled to use light filters. The study of various biological processes of the animal and vegetable kingdoms under the influence of monochromatic light has occupied men of science for some considerable time. By means of such investigations botanists have been able to prove that the formation of starch in the leaves of plants, by the carbonic acid in the air, takes place with greatest activity under the influence of red and yellow rays. The most convenient light filters would be coloured glass, but a pure spectrum colour is only obtainable with deep ruby. Other kinds usually transmit various rays of light, thus giving complicated absorption spectra when examined with the spectroscope. For instance, various kinds of glass which I have examined transmit the following rays:—

Pale ruby glass: red and orange rays (to wave-length 595.5); yellow glass: red, orange, yellow, and green (to wave-length 492); green glass: some orange, yellow, and green (that part of the spectrum between wave-lengths 598.8 and 488.5).

Moreover, as Dr. Nagel has correctly remarked, we seldom find glass of quite even colour. As for gelatine screens, they are quite irregular in colour and not perfectly transparent. They also deteriorate easily under the influence of heat and moisture, and, being stained with aniline dyes, are not permanent, and fade when exposed to sunlight. Among the more perfect light filters, those which contain coloured solutions in glass receptacles with parallel sides must be included. They are very transparent, perfectly uniform, and transmit much more light than coloured glass or gelatine plates.

Cells for coloured fluids are now made by various opticians. The State Securities Department (St. Petersburg) has four of these made by Zeiss of Jena. But they may be easily extemporised. According to N. Lachtin, they may be made of two squares of thin plate glass separated by strips of thick, flat plate glass of suitable length placed round three of the sides. They may be cemented together with a composition of five parts of resin and two parts of yellow wax. Alkaline solutions must not be used in these cells, as they would form an emulsion with the resin and soon render the cells useless. As the coloured fluids are generally used in 1 c. layers, the parallel walls of the glass cells should be that distance apart. If we now turn to the various coloured fluids, we shall also find that they give very complicated absorption spectra. In the years 1893 and 1894 Hruza and Hazura published a table of such spectra in their work upon "Light Filters and Sensitisers" (Strahlenfilter und Sensibilisatoren). These authors examined a very large number of organic dyes and mineral salts. It was found that only few red colours, such as palatine red, A (page 7), tuch red, G, extra (page 10), diamine-scarlet (page 15), and saffranin P (page 39), transmitted monochromatic light, even if in very concentrated solutions and in layers 1 c. thick. Solutions of other colours give more or less complicated spectra. I will only instance a few. Amongst yellow dyes, picric acid transmits red, orange, yellow, and green rays; aurantia, red, orange, yellow, and some green rays; chromate of potash, some red, orange, yellow, and green. The green solutions of methyl green and malachite green transmit red, green, and blue rays; sulphate and nitrate of nickel, orange, yellow, green, and blue rays; and chloride of copper, yellow, green, and part of the blue rays. The blue solution of cyanine transmits red, blue, and violet rays, sulphate of copper solution, a small part of the orange and the yellow, green, blue, and violet rays. The violet solutions, methyl violet, ethyl violet, crystal violet, and permanganate of potash transmit part of the orange and the blue and violet rays.

Dr. Nagel found that, if several different pigments are simultaneously dissolved in water, solutions are obtained which transmit monochromatic rays (more or less); but he did not give any details as to weight, as he combined the colours with the aid of the spectroscope, which is much more convenient than making up the quantities by weight. He recommends a solution of lithion carmine as a filter for red rays. Lithion carmine is prepared by dissolving 2.5 grammes of carmine in 100 c. c. of a saturated solution of carbonate of lithium. By diluting this saturated solution with water a fluid is obtained which transmits the red part of the spectrum as far as line, C. In this condition the fluid is rather dark, but it must not be forgotten that the greater part of the light is absorbed, and that the transmitted portion of the spectrum is consequently very small. We must also bear this fact in mind in connexion with other colour filters, and especially the yellow, through which only a very small band of the spectrum is transmitted. By further diluting the solution of lithion carmine we obtain, according to Dr. Nagel, a fluid which transmits the red and orange of the spectrum as far as line, D. It is considerably more luminous than ordinary ruby glass, and gives the same absorption spectrum. It is true that lithion carmine diluted to this extent transmits not only red and orange, but also a small portion of the blue rays, but the latter can scarcely be detected with the spectroscope. Hruza and Hazura also noticed this, and included blue in the spectrum of a very dilute solution of carmine. As proof of the transmission of the blue rays through a solution of lithion carmine, I would mention the following facts. It is well known that the blue rays are much more actinic than any other. Many light sensitive substances are apparently only reduced under the influence of blue and violet rays. The emulsion used for ordinary photographic plates belongs to this category. I ascertained the sensitiveness of ordinary Ilford plates by means of the scale of a Warnerke sensitometer, firstly for the rays transmitted by a dilute solution of lithion carmine (with absorption spectrum as far as the rays of wave-length 593.4), and, secondly, to rays transmitted by lithion-carmine and a concentrated solution of picric acid, which latter, it is well known, absorbs the blue and violet portion of the spectrum. The results obtained differed widely from each other.

In the first case ordinary plates (yellow label) exposed for two minutes gave No. 17 W. after development. In the second case, after twenty minutes' exposure, it was impossible to develop any number at all. Ilford isochromatic plates gave No. 17 in the first case after six minutes' exposure, and in the second case after twelve minutes' exposure. I also exposed some panchromatic plates made by Messrs. Lumiere upon Dr. Hubl's colour chart. A negative was made with a lithion-carmine filter, and another with lithion carmine and picric acid. The difference between them is very marked.

I may here mention a very good method, by which to ascertain if an orange-red screen transmits blue rays. If it is placed in front of a screen of saturated sulphate of copper solution (1 c. thick), the light transmitted by both is either brown-violet, or yellowish-brown. In the first case the screen under examination transmits blue rays, as may be seen with lithion carmine, erythrosine, and saffranin. In the second case the blue rays are cut off as with a solution of mandarin, to which I shall refer presently.

Dr. Nagel obtained a coloured screen, transmitting only the orange part of the spectrum between the Fraunhofer lines C and D, by dissolving saffranin and acetate of copper in water. He added to a concentrated solution of acetate of copper, which absorbs the red rays, a few drops of acetic acid, and then added drop by drop a concentrated solution of saffranin, until the violet, blue, green, and yellow rays were also absorbed, In this way a solution is obtained which transmits only that portion of the spectrum lying approximately between wave-lengths 640-600 (661.4—601.1).

Yellow Light Filters.—To a saturated acid solution of acetate of copper, which absorbs the red and part of the orange rays, add drop by drop a saturated solution "orange G" acidified with acetic acid, which absorbs the violet, blue, and most of the green rays. A brown fluid is thus obtained which transmits a small band of orange, the yellow, and a small part of the green rays, or that portion of the spectrum from 620-570 (610.9—569.4).

A greenish-yellow filter may be obtained, according to Dr. Nagel, by combining solutions of acetate of copper and bichromate of potash, or picric acid. If crystals of acetate of copper are boiled in an excess of saturated solution of bichromate of potash acidified with acetic acid, a green solution is obtained which transmits that portion of the spectrum between 580 $\mu\mu$ and 530 $\mu\mu$ (I obtained in this manner a solution which transmitted the rays between wave-lengths, 602.2—540.1). If picric acid is substituted for bichromate of potash, the solution transmits that part of the spectrum between wave-lengths 580—520 (according to my experiments between wave-lengths 608.2—499.7).

A green light filter may be obtained by combining a saturated solution of chromate of potash with a saturated solution of ammonio-oxide of copper. The latter is added to the solution of chromate drop by drop until all the red, orange, yellow, and greenish-yellow rays are absorbed. The portion of the spectrum transmitted by this solution lies between wave-lengths 535—495 $\mu\mu$ (according to my experiments between wave-lengths 555—508.0 $\mu\mu$). For absorption of the blue-green rays Dr. Nagel adds to the solution a few drops of an alkaline solution of fluorescine.

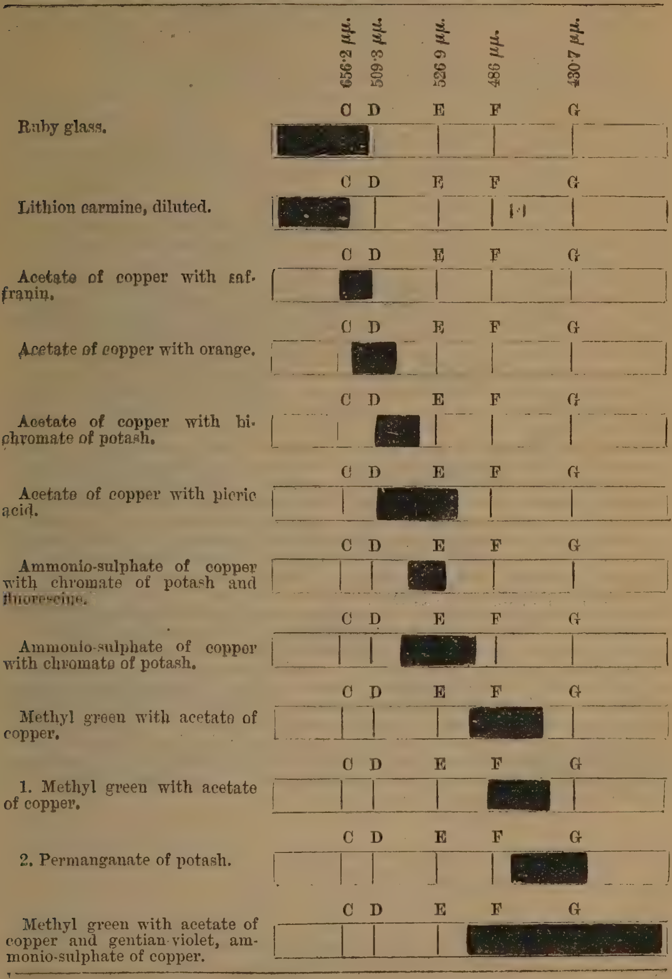
The blue part of the spectrum is transmitted by a weak solution of methyl green, but at the same time the extreme part of the red is also transmitted. The latter may be cut off by acetate of copper. To prepare such a filter, add to a solution of acetate of copper a concentrated solution of methyl green, drop by drop. The transmitted portion of the spectrum ranges from about 500—460. By placing in front of this screen another cell containing a weak solution of permanganate of potash, which absorbs the blue-green rays from 582.2—468.2, the part of the spectrum transmitted may be reduced to 486—460 $\mu\mu$. If we add to the blue solution a solution of gentian violet, drop by drop, we can isolate that portion of the spectrum from 460—430 $\mu\mu$.

The violet portion of the spectrum (from 470—410 $\mu\mu$) may be obtained by using two solutions: ammonio-oxide of copper (1 part of saturated solution to 7 parts of water transmits the rays as far as wave-length 541) and a solution of permanganate of potash. As these solutions should not be mixed, they must be used in a double cell. The following table by Dr. Nagel gives the spectra of the light filters we have mentioned.

Dr. Nagel examined his light screens by means of an incandescent burner. As I followed the recipes given in his work, I also used the same source of light. I should add that Dr. Nagel describes very fully and completely how the light filters may be prepared, but I cannot agree with him that their preparation is very easy and simple. As an instance, I may mention the preparation of the green light filters.

Adding the saturated solution of ammonio-oxide of copper drop by drop to the saturated solution of chromate of potash is a very tedious operation, quite apart from the circumstance that more of the cupric solution may be added than is requisite. Moreover, the second solution is diluted in unequal proportions by addition of larger or smaller quantities of the first solution, and its original standard of absorption is thus subject to irregular variation. Lastly, a turbid deposit is formed when some of the solutions are mixed, and this must be removed by filtration. It is therefore very difficult io prepare two light filters which give identically the same absorption spectrum. Monochromatic filters may be prepared much more easily in another way which I have used for some years.

WAVE-LENGTHS ACCORDING TO ANGSTROM.



In 1894 the following problem was given me. A specialist offered the State Securities Department a new process for preventing forgery of credit notes. His proposal was to print the design, ornament, writing and protective network in different coloured inks, each having the same effect upon a photographic plate. In this way, by use of photographic processes, it would be impossible to obtain the design of the protective network without, at the same time, including the writing and ornament. It was required to find some method by which the various colours could be separated by photographic means. If the colours could not be differentiated, the process which was offered would be of great value in the printing of credit notes. However, by use of the colour filters I have mentioned and various kinds of orthochromatic plates, I succeeded in photographing the colours separately. By comparing the absorption spectra of various coloured fluids I found that, by combining them in layers 1 c. thick, I could ultimately isolate any portion of the spectrum. For instance, if we take a solution of mandarin G extra, Orange II.* in proportion of 1 part of saturated solution to 1 part of water, so that only the red and orange rays (to wave-length 590.2 of the spectrum) are transmitted, and, if we also take a solution of sulphate of copper, 1 part of aqueous saturated solution to 4 parts of water, which transmits orange, yellow, green, blue, and violet (that part of the spectrum as far as wave-length 654.6 $\mu\mu$), and, if we fill each division of a double cell with one of these fluids, then only the orange rays can pass through the combined filter, for the red rays are cut off by the solution of copper, and the yellow, green, blue, and violet by the solution of mandarin. The requisite strength of the solutions can be determined with sufficient exactitude by means of the spectroscope. If we take a still more dilute solution of mandarin (1 part of saturated solution to 3 of water) so that the red, orange, and yellow rays (to wave-length, 579.3 $\mu\mu$) are transmitted, and likewise a saturated solution of chloride of copper, which transmits yellow, green, and part of the blue rays (region of the spectrum form wave-length 589.4—469.6) we have a combination of solutions which transmits pure yellow light. The same solution of mandarin (1 part to 3 of water) combined with a saturated solution of sulphate of copper (which transmits that part of the spectrum to wave-length 618.8 $\mu\mu$) gives a small band of the spectrum comprising the yellow and a small portion of the orange rays. Pure green rays are isolated by combining a solution of ammonio-oxide of copper (1 part of saturated solution of copper sulphate, 15 parts water, 1 part ammonia 0.91) with a solution of bichromate of potash (1 part of saturated solution to 10 parts of water), or saturated aqueous solutions of chromate of potash or picric acid may be substituted. I combine the solutions by means of a double cell formed of three plates of glass, the middle of which divides the enclosed space in two sections. In this way the two solutions in the separate divisions do not mix with each other. It is true that by combining the solutions in this manner another reflecting surface is introduced which entails some loss of light, but the diminution is comparatively small. I commend the following table of absorption spectra to the notice of photographers:—

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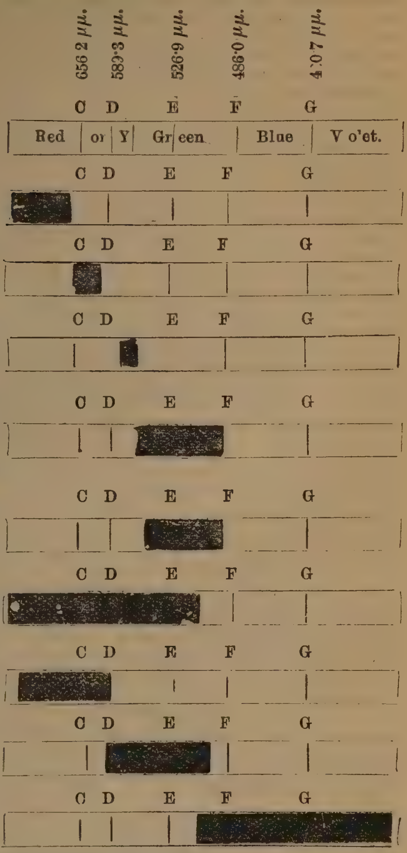
* This dye (in solution of 1 in 1000) has been used since 1895 by Herr W. Weissenberger as a filter for making the blue negative in three-colour work.

WAVE-LENGTHS ACCORDING TO ANGSTROM.



a. Lithion-carmine, dilute

b. 1. Mandarin G extra (1 pt. sat. sol.+1 pt. water)
2. Sulphate of copper 1 pt. sat. sol.+4 pts. water)

c. 1. Mandarin G. extra (1 pt. sat. sol.+3 pts. water)
2. Chloride of copper saturated solution

d. 1. Ammonio-oxide of copper (1 pt. sat. sol. sulphate of copper+15 pts. water+1 pt. ammonio 0 91)
2. Picric acid (saturated aqueous solution)

e. 1. Ammonio-oxide of copper solution as (above)
2. Bichromate of potash (1 pt. sat. sol.+10 pts. water)

f. Picric acid (saturated aqueous solution)

g. Mandarin G extra (1 pt. sat. ssl.+1 pt. water)

h. Chloride of copper (sat. sol).

i. Ammonio-oxide of copper (1 pt. saturated solution of sulphate of copper+6 pts. water+1 pt. ammonia)

I will now proceed to the application of these light filters to photographic purposes.

It would be particularly interesting to ascertain the sensitiveness of various kinds of orthochromatic plates for the pure colours of the spectrum by means of some kind of sensitometer. It is only by such means that we can arrive at a quantitative expression of the capacity of various sensitisers to increase the sensitiveness of photographic plates for the various rays. In such a manner only can we ascertain the exact difference between two sensitisers of similar character, as, for instance, eosine and erythrosine. Moreover, as soon as we can ascertain definitely for which rays the plates in question are least sensitive, we can illuminate our dark room with that kind of light. For this purpose I have constructed a lantern, the front of which is made of a double glass cell consisting of three parallel glass plates. The two divisions may be filled with any suitable coloured fluids to isolate any particular kind of monochromatic light. Unfortunately, I have not yet had sufficient spare time to make an exhaustive series of experiments. For this purpose it would be necessary, by means of a constant source of light, to measure photometrically the quantity of light transmitted by each colour filter, and thus ascertain the most suitable type of sensitometer for the series of experiments. I have only made a few experiments in this direction, but they may be of interest to the practical photographer. I selected for my experiments three colour filters of approximately the same intensity, namely, a saturated solution of picric acid; as green-yellow filter, a combination of the solutions of acetate of copper and picric acid; and, as red-orange filter, a combination of lithion-carmine solution and picric acid solution (it would be more convenient to use solutions of mandarin of suitable strength). The first, a pale yellow solution, transmitting the red, orange, yellow, and green rays to wave-length 488.8 $\mu\mu$, divides the spectrum in two parts, namely, a slightly actinic half and an energetic chemically active half. It would also be interesting to thoroughly investigate the sensitiveness of orthochromatic plates to the action of all the less active rays. Orthochromatic plates may be divided into those which are sensitive to red or to green light. I have endeavoured to ascertain the sensitiveness of these two colours by means of two other colour filters, which also divide the less actinic half of the spectrum into two parts. The sensitiveness of the plates was determined in the following manner. Having made a hole in the wall of the dark room, I inserted therein a Dallmeyer lens and placed in front of it a spirit lamp with an incandescent burner rather nearer than the focal point. I found this light sufficiently constant, inasmuch as I obtained the same number from a series of exposures with the same kind of plates. The light filter was placed immediately in front of the lens. In the dark room I obtained a conical, divergent pencil of coloured light, and I placed the plate covered by the Warnerke sensitometer in such a position that the whole surface of the scale was illuminated. I had, of course, removed the phosphorescent tablet . The following plates were tested: Ilford Ordinary (yellow label), Ilford Chromatic, Edwards' Isochromatic, Lumiere's Panchromatic, and Smith's Orthochromatic (red mark). I first ascertained the sensitiveness of the various plates by means of the phosphorescent tablet, and then tested their sensitiveness for coloured light. The numbers secured are given in the following table, the sensitiveness of the Ilford Ordinary plate being taken as the unit. With the red filter, however, the sensitiveness of the Ilford Chromatic plate was taken as the unit.

The Ilford Chromatic plates were found to be the most sensitive to green, and Lumiere's Panchromatic to red. Smith's plates were found less satisfactory in both respects. These results brought me to the conclusion that for subjects in which green predominates it was best to use Ilford Chromatic plates. On the other hand, where red, warm tones predominate, Lumiere's Panchromatic plates would do good service.

The application of monochromatic light filters and corresponding orthochromatic plates could, by means of Burinsky's* system of colour separation, lend valuable assistance in the examination of doubtful documents. Moreover, it is easy to select from the light filters here enumerated, those which may be used with greatest advantage in conjunction with suitable orthochromatic plates for making negatives for reproductions by the three-colour process. In conclusion, I would draw attention to the following three-colour filters: (1) a solution of ammonio-oxide of copper (1 part of saturated solution of sulphate of copper + 6 parts of water + 1 part of ammonia; (2) a solution of mandarin (1 part of saturated solution + 1 part of water), which transmits the orange-red rays; (3) a solution of chloride of copper, which transmits only the yellow and green rays. These three in conjuction transmit the entire spectrum, and supplement each other. It therefore follows that, if the rays transmitted by these solutions are projected simultaneously upon a screen, we should have white light, but I have not yet had an opportunity to verify this. If, however, this conclusion is found correct, these light filters should be very suitable for Ives's Photochromoscope.

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* Burinski, photographic specialist for doubtful documents to the St. Petersburg District Court, whose photographic treatise was published in 1896 in the *Bulletin der Kaiserlichen Akademie der Wissenschaft.*

	Phosphorescent Table	Yellow Filter.	Green Filter.	Red Filter.
Ilford Ordinary (yellow label)	17 W. 1	2 min. 17 W. 1	2 min. 17 W. 1	20 min. No action. 0
Ilford Chromatic	17 W. 1	5 sec. 24 W. 168	30 sec. 25 W. 36	12 min. 17 W. 1
Edward's Isochromatic	23 W. 5	15 sec. 25 W. 72	1 min. 25 W. 18	12 min. 18 W. 1⅓
Lumière's Panchromatic	23 W. 5	30 sec. 25 W. 36	1 min. 23 W. 10	1 min. 19 W 21
Smith's Orthochromatic (red mark)	15 W. 4	5 sec. 17 W. 24	30 sec. 20 W. 9	12 min. 8 W. very feeble.

TEACHINGS OF DAGUERREOTYPE.

[The second Traill Taylor Memorial Lecture, abstracted below, was delivered by Major-General Waterhouse in November 1899, when the Almanac for 1900 was passing through the press. It may be explained that the lecture is annually delivered in memory of the late Mr. J. Traill Taylor, who was for 30 years Editor of this Almanac and The British Journal of Photography.]

Value of Daguerreotype as a Teaching Process.

Although Daguerreotype has long been abandoned, it is capable of teaching us a good deal about the action of light on the silver haloid compounds which form the basis of our modern dry plates, as Professor Meldola has pointed out in his "Chemistry of Photography." It may therefore well form the starting point of lectures in the present series, dealing with photographic processes based on salts of silver.

Daguerreotype was for a long time considered a unique and perfectly special process without any intimate connexion with the ordinary photographic processes, and, of course, so long as mercury alone was used for the development of the invisible image on the silver plates, it was so to a very great extent. Carey Lea was among the first to show that this view is erroneous, and that the Daguerreotype image is subject to the same laws as govern he wet-collodion and other processes for making negatives. Last year I was able to go further in this direction and show that Daguerreotype plates could be developed in a practical way by the ordinary acid ferrous sulphate and silver, or acid pyrogallol and silver used for wet collodion plates, as well as with ordinary dry-plate developers, though in this latter case only faint negative images were produced. I also showed that the sensitive surface of iodised or bromo-iodised silver could be rendered more sensitive by treatment with suitable organifiers or halogen absorbents, such as tannin and similar bodies, as in the old dry-collodion processes, and that they could be rendered orthochromatic or colour-sensitive by treatment with suitable dyes, like collodion or gelatine plates. The process may therefore be looked upon as an epitome of the photo-plate, and from this point of view is of special value, because it depends upon the employment of haloid salts of silver formed by the direct union of the halogen and the metal, and therefore in their most simple and purest forms as regards freedom from organic mixtures and complications.

This being the case, we ought to be able to derive a good deal of valuable information from a careful investigation of this process in its various stages and modifications with different halogens or combinations of them, and with different methods of developing and dissolving away the images formed by the action of light. From such an examination I think we ought to be able to obtain fuller knowledge of the probable nature and method of formation of the invisible developable image; and, even if we do not succeed in this, we may, at any rate, acquire information which may be of use in future investigations. The subject is one of considerable difficulty, and one which I feel requires very much fuller special knowledge and more time and attention than I have been able to bestow upon it. In fact, I have only been able to carry out a small part of the programme I sketched out above.

SENSITIVENESS OF SILVER TO LIGHT.

I can find very little recorded about the sensitiveness of metallic silver to light beyond the fact that Moser found that silver, in common with most other metals, was sensitive to light. He exposed a silver plate for some hours in weak sunlight under a dark cut-out screen which was not in contact with it, and when the plate, which showed no change, had been allowed to cool, it was exposed to the vapour of mercury at about 170° Fahr. A clear image of the screen was produced, those parts where the light had acted had caused the deposition of a quantity of mercury. Plates of dark mirror glass and copper treated in the same manner showed the same result.

The series of phenomena which were dealt with in Moser's researches, especially those connected with the production of contact images, are, however, so peculiar in their results that it is still difficult to know to what cause they are really due. They have generally been attributed either to some impurity of the surface itself, to vapours given off by it, or to thin films of air or other substances in contact with it or otherwise affecting it. Robert Hunt was of opinion that many of Moser's effects were due to heat or thermic radiations.

In discussing the contact phenomena, the discovery of the sensitiveness of silver to light, as shown by the experiment described, has been overlooked, but I have been able to verify it, and, in addition, to obtain a visible printed-out image on the plain silver plate without any previous preparation—as you will see—also on silvered glass plates. In both cases the light seems to exercise a bleaching action, *i.e.*, the exposed parts appear lighter than the unexposed and attract the vapour of mercury. By other experiments as to the electrical behaviour of silver partly exposed to light and partly unexposed, both in the dry state and immersed in water and other liquids, I have found that silver, though not very sensitive, does show undoubted sensitiveness, and it is also shown by the change of colour of silver deposited on the cathode plate of a cell through which an electric current has been passed.

Carey Lea found that the three forms of allotropic silver he obtained, viz., A, the red soluble; B, the dark brown or blue insoluble variety; and C, the golden coloured, were acted on by light. A and B became brown after some hours' exposure, but with C the colour became lighter. This last result is similar to some of my own observations.

The oxides of silver are all sensitive to light and are decomposed by it. According to Hunt they lose oxygen by exposure, being first converted into a suboxide and then into metallic silver. In presence of organic matter the reduction is more complete.

HYDROGEN PEROXIDE A SENSITISER FOR SILVER.

I have also obtained some very interesting results with silvered glass plates fumed with peroxide of hydrogen before exposure, and find that it is capable of acting somewhat in the same way as iodine in sensitising the plate.

Mendeleeff remarks that the nearest approach to the properties of hydrogen peroxide is afforded by a non-metallic element—chlorine; its action on colouring matters, its capacity for oxidising and for evolving oxygen from many oxides is analogous to that exhibited by hydrogen peroxide. I do not know to what extent this similarity of hydrogen peroxide to chlorine extends to the other halogens, but the fact that there is such a relation, and that we find that hydrogen peroxide can act as a sensitiser to silver, seems worth noting for further inquiry. I have here three plates, one sensitised by fuming with peroxide of hydrogen, another with chlorine, and the third with iodine; the results, after exposure to light and development with mercury, are practically the same on all three.

In the case of Daguerreotype, as in other photographic processes with silver compounds, the sensitiveness of silver itself to light has hitherto not been regarded as in any way an essential factor in producing the results, which are usually attributed to the action of light upon the haloid compounds. It is, however, certainly of interest to know that it is sensitive, and even visibly so, and that images can be produced upon it by the action of light, which may be developed by condensation of mercury vapour, or by the precipitation of molecular silver with an ordinary acid iron and silver developing solution. As a matter of fact, nearly all the photographic phenomena, such as the development of an invisible image, the production of a visible image, reversal by over-exposure, and the effects of pressure in producing a developable image can be shown on the plain silver plate.

A further investigation into the nature of these images would be very interesting, and might show that the part played by the silver is a more important one than is usually assigned to it, and that this is the case seems to be shown by some of the results obtained in printing out on the iodised Daguerreotype plates.

PROPERTIES OF THE HALOGENS.

We now come to the halogens generally used in combination with silver. Though not very sensitive to light in the pure form, chlorine, iodine, and bromine are so when combined with other substances. They are all marked by their strong affinity for hydrogen, and to this is probably due the ready decomposition of substances containing them when exposed to light in presence of water or organic substances containing hydrogen. Compounds of chlorine are the most readily decomposed in presence of hydrogen, then those of bromide, and lastly those of iodine.

Chlorine may be combined directly with hydrogen under the action of light, but not iodine. Bromine and hydrogen combine under the influence of light at 196° C., and form hydrobromic acid. Watery solutions of chlorine and bromine are decomposed by light with formation of the corresponding hydrogen acids. A watery solution of iodine is not decomposed by light, but a solution in alcohol is so to a slight extent. The blue iodide of starch is distinctly sensitive to light.

The relation of the halogens to hydrogen is the reverse of their relations to oxygen, for which iodine has a much greater affinity than chlorine, while bromine occupies an intermediate position. In presence of water iodine can act as an oxidiser, but has very little bleaching power. Iodine, however, does not combine with oxygen under the influence of sunlight, either in presence or absence of water. There is no combination either between bromine and chlorine with oxygen in sunlight. It may be noted also that oxygen is not converted into ozone by the action of sunlight.

According to Mendeleeff (English translation, 5th edition, I. 465), under the influence of light chlorine is able to replace hydrogen by virtue of an action termed metalepsis, which is always accompanied by the formation of hydrochloric acid. In the dark chlorine does not usually act on hydrogen compounds, but the action commences under the influence of light. The direct action of the sun's rays is particularly propitious to it. It is also remarkable that the presence of traces of iodine added to the substance subjected to metalepsis often produces the same effect as sunlight. This action may be due to the formation of iodine chloride, which reacts more easily than chlorine. Bromine and iodine possess the same properties. Iodine itself, however, does not act by metalepsis on hydrocarbons on account of the easy decomposability of hydriodic acid, especially under the influence of light.

And not only their oxygen compounds, but also their hydrogen compounds, have acid properties, the halogens are elements of an exclusively acid character. This character is more strongly developed in them than in any other elements. This acid character of the halogens is very distinctly marked in all photographic processes.

Robert Hunt says of them ("Researches on Light," p. 279): "Chlorine, iodine, and bromine, it is well known, act with considerable energy upon metallic bodies. If, however, any polished metal is exposed to the action of them in a diluted state, the combination is at first exceedingly small, and the films that are formed by either of these three elementary bodies upon any metal undergo considerable change under the influence of the sun. In most cases it appears that these bodies are set free, and the metal left in a state of very fine division of oxidation. Copper, tin, iron, zinc, lead, pewter, bismuth, and several other metals have afforded the same results. It is still more remarkable that films of bromide or iodine on glass are found under the action of the sun to act in a similar manner."

Combinations of Halogens with Silver.

According to Mendeleeff, silver gives insoluble and exceedingly stable compounds with the halogens. They are obtained by double decomposition with great facility whenever a silver salt comes into contact with halogen salts. (As I lately showed, this combination takes place even with dry powdered salts.) The degree of affinity of silver for iodine is greater than that for chlorine or bromine, so that, when exposed to light, the iodide does not part with its iodine as the chloride and bromide do with a portion of their chlorine and bromine.

Beketoff has explained the fact that silver iodide is more stable than the chloride of oxide by an original hypothesis—that the most stable compounds are those in which the weights of the combined substances are equal. Thus silver oxide is less stable than the chloride, and the iodide is the most stable.

Silver iodide is also more stable in respect to the action ofy light than silver chloride. Silver chloride quickly darkens, and appears to be decomposed into chlorine and silver. Silver bromide and iodide are much more slowly acted on by light, and, according to certain observations, when pure they are quite unacted on—at least, they do not change in weight; so that, if they are acted on by light, the change they undergo must be one of a change in structure of their parts, and not of decomposition, as it is in silver chloride. Silver iodide in presence of a large excess of silver, as in the Daguerreotype plate, darkens as readily as the chloride does when exposed with excess of silver nitrate.

As a combination of silver with iodine vapour forms the basis of the sensitive surface of the Daguerreotype plate, we may first of all consider it.

SILVER IODIDE.

Silver iodide is usually formed by precipitation from mixtures of solutions of silver nitrate and potassium or other metallic iodide. According as the silver or iodide is in excess, it has either a full yellow colour and is slightly darkened by light, or a very pale yellow colour, almost white, and is scarcely changed in colour by light.

We are, however, more interested in the comparatively little known forms of anhydrous iodide produced by the direct union of silver and iodine, and generally in immediate contact with metallic silver.

Before proceeding to consider the composition and behaviour under the influence of light of the sensitive surface of silver iodide on the Daguerreotype plate, it may be as well to examine the action of iodine upon silver in a very fine state of division. This can be readily done by adding iodine in various proportions to precipitated silver, and the resulting mixtures are more easily tested with various reagents than can be done on a plate.

Unless the iodine is in a very small proportion compared with the silver powder, the two may combine with a sudden rise of temperature and flame, the iodine vapourising and going off in violet fumes. The iodine must therefore be added only a little at a time, and be kept constantly stirred. In this way the full quantity required to produce the iodide, AgI, may be added.

Mixing precipitated silver thus with iodine in different proportions, such as 108 parts by weight of silver to 12.7, 37.1, 63.5, 95.2, and 127 parts by weight of iodine, we obtain a series of powders varying in colour from a grey or chocolate brown to an olive yellow, and finally brick-red tint. This last was shown by the preparation containing 108 parts of silver to 127 of iodine. It still contained a quantity of uncombined iodine as well as some uncombined silver inside the grains, but, if left in, the air for a short time the excess of iodine evaporated and the powder turned to a deep orange yellow.

All the lower compounds are readily blackened by light, but the higher ones, with 63.5 parts of iodine (subiodide, Ag_2I, (?)) and upwards, are not so visibly blackened, and with the full quantity of silver and iodine to form the iodide (AgI) the mixture does not blacken at all in the light, just in the same way as the ordinary yellow iodide prepared by precipitation is not blackened.

This shows that the darkening is a function of the silver, increasing with the excess of silver and diminishing or entirely disappearing with excess of iodine.

It, however, we add precipitated silver to iodine, the yellow iodide is not formed at all, even when the full combining proportion of silver is added. This seems to be due to the iodine forming a coating on the silver grains which stops further action. The resulting compound is of a dark brown colour with no grains of yellow iodide, as is the case when the iodine is added to excess of silver. By leaving the brown mixture till the excess of iodine has gone we obtain the same brick-red compound, which becomes yellowish on further exposure to the air. If more silver be added to take up the excess of iodine, the lower compounds are formed. I have not been able to very closely examine these curious compounds or mixtures of silver and iodine, but they seem worth further investigation.

There is one curious fact connected with the darkening of these mixtures or lower iodides which has already been noted, and that is that there is no loss of weight after exposure to light. Iodine is not set free, as is the case with chlorine or bromine, and it is difficult to know what the action really is, and whether there is any chemical decomposition by catalysis or otherwise, or whether the change is only structural. Recent researches by H. Scholl, to which attention was drawn further on, seem to throw considerable light upon this question.

Composition of the Sensitive Surface of the Daguerreotype Plate.

That the sensitive surface of the Daguerreotype plate is formed by one of these lower compounds of silver and iodine, and not of the pure iodide, AgI, is, I think, shown by the fact that, if we iodise a thin film of silver leaf or silver on glass till all the silver has combined with iodine, we obtain an almost transparent pale yellow film, which no longer darkens very visibly even in bright sunshine, and is very insensitive, requiring long exposures to produce even the developable image. If, however, we expose a fairly thick plate of silver for several hours to the fumes of iodine, this yellow iodide is not formed at all, and we have instead a dark brownish or olive-coloured deposit, which is readily darkened by light, just as the iodised silver mixtures were, and as the Daguerreotype plate is. Some of this darkened deposit, treated with potassium iodide partly dissolved, the remainder still retaining its blackness; the addition of distilled water turned it yellow, the further addition of KI further dissolved it, but still left in a dark purplish precipitate, which, being treated with nitric acid, behaved exactly like the original unexposed deposit, evolving iodine. HCl gave no precipitate of silver chloride, and therefore free metallic silver could not have been present.

Hence the surface of the Daguerreotype plate may be looked upon as iodised silver, or a compound containing a very small proportion of iodine in more or less loose combination with a very large excess of silver. On exposure to light no iodine is set free or lost, but compounds are formed at the surface containing a larger proportion of silver, and therefore darkening more readily up to a certain limit, while the iodine penetrates more deeply, and attacks the underlying silver surfaces. That this is the case is shown by the fact reported by Moser, and also by Robert Hunt, that the darkened surface of an exposed Daguerreotype plate may be removed several times over, and still the under surface will remain sensitive. I have myself done this fifteen times over without exhausting the iodine or entirely destroying the printed-out image first impressed on the plate, and it was very remarkable how this original image came up apart from the ground after each exposure, which was taken up to solarisation point or beyond.

If, however, the proportion of silver to iodine is normal or in defect, and we have the anhydrous yellow iodide or orange super-iodide formed, we find that it does not darken in light, or only becomes a deeper yellow. A sample of pure yellow iodide, which was obtained from a well-known firm, shows this effect very distinctly on exposure to strong sunlight, but it loses this deeper colour again in the dark, becoming once more a pale lemon yellow.

Professor Meldola has suggested that the silver iodide on the Daguerreotype plate forms its own sensitiser, and from what I have seen of the deepening in colour of the above samples of iodide and others under the influence of light, or when treated with an excess of iodine, I have little doubt that this is the case. As we shall see later on, iodine may even exert an active sensitising action upon pure silver iodide.

TALBOT'S IODINE RINGS.

One of the most striking points with regard to the action of iodine on a polished silver plate is the series of interference colours it produces, in accordance with the thickness of varying composition of the film of iodide produced, and I cannot do better than show you an old experiment which was first tried by Fox Talbot, and described in the "Athenæum" for 1839, p. 643, also in Hunt's "Researches on Light," p. 102. If we place a small crystal of iodine on a polished silver plate or a silvered glass, and warm it gently with a spirit lamp, we shall at once see a series of about seven sets of concentric rings, forming prismatic or interference colours exactly similar to those of Newton's rings, or rather Nobili's rings, which are Newton's rings reversed. First, outside we have a bright yellow, and within this there arise successfully rings of green, red, and blue, and then again a fine yellow circle, centered by a greyish spot on the place occupied by the iodine. Now, if we cover up one-half of the series of coloured rings and take the plate into the sunshine, we shall see one of the most striking and beautiful exemplifications of the action of light it is possible to conceive. The rings are sensitive to light, their colours change and become intensified, producing quite a new series of rich prismatic tints, which completely illustrate and prove the fact I have just drawn your attention to, that darkening increases in proportion to the excess of silver, and lessens with the increase of iodine. The outer circle, which before exposure was only a pale rose colour (the most sensitive iodide colour), is now a deep brilliant green shading into a strong reddish-violet, and then into beautiful dark blue, succeeded by a broad white or very pale green merging into a deep yellow, succeeded by a series of fine well-marked concentric rings of much the same tint as the original unexposed rings, but deeper and brighter. The tints vary somewhat according to the length of exposure. The outer rings produced by the thinnest stratum of iodised silver, furthest from the centre, must be in a very loose state of chemical aggregation. Talbot says the coloured rings seem to consist of silver iodide in various stages of development. If we turn the plates downwards at an angle of 45° to the light, we shall see that the colours are reversed and show complementary tints.

There is another method due, I believe, to Wiener, by which these colours can be shown, and almost more brilliantly, by resting the plate on a glass cylinder while being iodised. This produces a double set of coloured bands, one on each side of the central blank space, as you will see. Viewed by reflected light, the complementary colours are very rich and almost fluorescent in their luminous intensity.

These gorgeous tints do not, however, represent any distinct chemical change in the composition of the sensitive surface beyond the production of films of iodised silver of varying thickness; and, if after exposure to light we submit the plate to the fumes of mercury vapour, or treat it with an acid iron and silver developer, we shall get no distinct image of the series of rings, but only two or three bands or regions of increased or diminished sensitiveness. With short exposures these bands are fairly distinct, as you will see from the example I have with me. The same result is obtained with images simply fixed with hyposulphite of soda. The outermost rings show an increase of action which is succeeded in the broad bluish or greenish-white band by a decrease, the action increasing again towards the central series of rings. The behaviour of these coloured rings under coloured glasses will be noticed further on.

RELATIVE SENSITIVENESS OF TINTS PRODUCED BY IODISING.

The relative sensitiveness of the various tints produced on the surface of a Daguerreotype plate by the vapour of iodine was first studied by Professor J. W. Draper, of New York, and his results are recorded in a paper published in the "L.D.E. Phil. Mag." for September, 1841. He found that the plate passed through the following stages of colour:—

1, lemon yellow; 2, golden yellow; 3, reddish yellow; 4, blue; 5, lavender; 6, metallic; 7, yellow; 8, reddish; 9, green, &c., the differences of colour being produced by the differences of thickness in the film of iodide, and not by any difference of chemical composition.

Talbot's rings show this fairly clearly. The outer rings are coloured much as stated by Draper, then comes the strong second yellow, followed by red and green, and, as the iodine acts longer and produces a thicker film, the rings become closer and darker as well as less sensitive to light. I find, however, that they attract mercury vapour readily, after exposure.

Having prepared nine plates showing the different tints above indicated, Draper exposed them under uniform conditions to the light of a gas flame, and found that No. 1 showed a well-marked action; No. 2, still stronger; but that the rays had less and less influence down to No. 6 (metallic), in which they appeared to be almost without action; but, in No. 7 (second yellow), they had recovered their original power, being as energetic as in No. 2; and from that they declined again.

Hence, as Draper says, we see that the sensitiveness of the iodide of silver is by no means constant; that it observes periodical changes, depending on the optical qualities of the film, and not on its optical composition; that, by bringing the iodide into those circumstances that it reflects the blue rays, we greatly reduce its sensitiveness, and still more so when we adjust its thickness so as to give it a grey, metallic aspect; but, the moment we go beyond this and restore by an increased thickness its original yellow colour, we restore also its sensitiveness.

Upon this and other observations, Draper, so early as 1841, laid down, among others, two important propositions upon which all photographic action is based:—

"That the chemical action produced by the rays of light depends upon the absorption of those rays by sensitive bodies, just as an increase of temperature is produced by the absorption of those of heat.

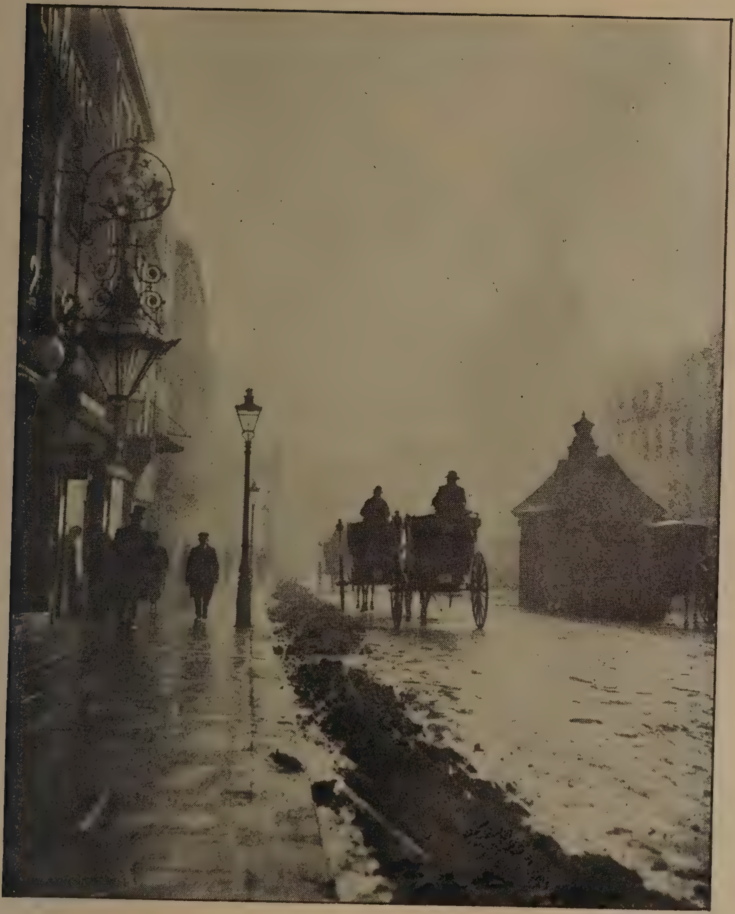
"That the sensitiveness of any given substance depends on its chemical nature and optical qualities conjointly, and that it is possible to exalt or diminish the sensitiveness of any chemical compound by changing the character of its optical relations."

The first of these propositions has been termed by Professor Meldola Draper's law.

The practical application and extension of this principle led the late Dr. H. W. Vogel to the discovery of the modern system of orthochromatic photography, and by applying suitable dyes, or, as he called them, optical sensitisers, to the ordinary photographic dray plates, he found that they could be rendered sensitive to the rays at the less refrangible end of the spectrum for which they are ordinarily insensitive. I cannot, at present, go further into this question, but it is important to note that this most important discovery was based to some extent upon Draper's observations of the different degrees of sensitiveness produced on Daguerreotype plates, according as the colour of the sensitive surface of silver iodide affected its absorption of the rays of light.

DEVELOPING ACTION OF RED AND YELLOW LIGHT.

One of the most curious and remarkable phenomena connected with the early working of Daguerreotype plates is the action of red or yellow



Neg. by W. E. Dunmore.

DEAR DIRTY LONDON.

From a Photograph taken with a TELLA CAMERA.

Printed by Percy Lund, Humphries & Co., Ltd., The Country Press, Bradford;
and 3, Amen Corner, London, E.C.

light upon the images formed either in the camera or by printing out. Thus, if we give a short normal exposure to an iodised silver plate, and instead of developing it in the ordinary way by the vapour of mercury or by treating it with an acid iron, and silver developer, we expose it in the sun under a red glass from fifteen to twenty minutes, we shall find to our astonishment a completely printed-out image, containing quite as much, if not more, detail than would have been shown by the deposited mercury or silver, while the protected parts originally unaffected by the light remain perfectly unchanged, and, on fixing with hyposulphite of soda, retain all their original brilliancy and clearness, as you will see. The curious thing is that the iodised silver coating shows itself quite insensitive to the action of light passing through the same red glass which, after even the faintest action of white light has affected the sensitive surface, will continue the action and carry it to full intensity, and even on to bronzing or solarisation.

This phenomenon seems to have been first discovered by Ed. Becquerel when working with the spectrum. He found that if an iodised silver plate were exposed to the spectrum it was not sensitive beyond a point more than half way between G and F; but, if the plate had previously received a short exposure to light, it was then sensitive to the whole length of the spectrum up to B, and from this point to beyond A there were signs of reversal or destruction of the image. Becquerel, therefore, called the rays at the most refrangible end of the spectrum the rayons excitateurs, while those at the lens refrangible end he called rayons continuateurs.

Shortly afterwards Gaudin succeeded in developing an image as perfect as that produced by mercury by submitting the plate when taken from the camera to the action of light under a yellow glass and without any subsequent exposure to mercury.

Claudet, Hunt, and others also investigated this curious phenomenon, and a good many explanations were put forward regarding it, but the one given by Bunsen and Roscoe in their paper "On the Phenomena of Photo-chemical Induction," in the "Phil. Trans. Roy. Soc," 1859, p. 400, whether correct or not is interesting in other respects. As it is not generally known, it may be worth quoting from the original, because it seems to have a distinct and important bearing upon other obscure phenomena connected with the formation of the invisible developable image on photographic plates of all kinds.

PHOTO-CHEMICAL INDUCTION.

By photo-chemical induction the authors mean the act by which the resistance to chemical combination of different bodies is diminished by the active agency of light.

"The laws of photo-chemical induction which we have here developed, explain most completely many of the singular phenomena which lie at the foundation of the photographic processes. Without entering into detail concerning the relations which these laws bear to the general processes of the photographer, we will now merely consider one phenomenon which has been so difficult to explain, that it has been found necessary to assume the existence of certain rays endowed with very peculiar propertiees, to which the name of rayons continuateurs has been given. This phenomenon was first established by Edmond Becquerel from the following observations. If one-half of an iodised plate of silver or a sensitive photographic paper be protected from the action of light whilst the other half is exposed to a constant source of light for such a time that no alteration, either perceptible to the eye or capable of being developed by photographic preparations, is effected on the sensitive surface, the plate possesses the property, when exposed to a uniform but very slight amount of light, to blacken on the insolated half, whilst the part not previously exposed remains unaffected. If, in the first short insolation, every part of the plate was not exposed to the same intensity of light, the blackening effected by the following uniform exposure corresponds to this intensity, so accurately, indeed, that a Daguerreotype picture commenced by this slight exposure may be developed by subsequent uniform insolation, almost as perfectly as if each amount of light represented on the picture, and not a constant amount, had acted for the whole time upon the plate. The explanation of this fact does not require the assumption of a new class of rays, which cannot commence, but only continue, the photo-chemical action. The phenomenon is in reality a simple consequence of the laws of photo-chemical induction, and proves that these relations, which we have examined only in the case of chlorine and hydrogen, occur in a slightly modified form in other photo-chemical processes. If the chlorine and hydrogen mixture were a solid substance which could be fixed upon paper without diminishing its sensibility to light, this paper must exhibit exactly the same singular property which Becquerel first observed with the Daguerreotype plate, or other photo-chemically sensitive surface."

They then prove this by examples taken from their actual experiments.

In the first case, if it takes, say, five minutes before any chemical decomposition of the sensitive surface is effected, and a plate has one half protected from light and the other half exposed for five minutes, although both parts show no visible action, the exposed half has five minutes' start, and if the whole plate be now exposed to uniform insolation, the half previously exposed will act quite differently from the half which remained in the dark.

The exposed half begins darkening at once, gaining intensity every minute, while the unexposed half must remain for five minutes before any darkening action can take place.

The second case is similar. An image commenced by lights of various degrees of intensity is developed by a subsequent uniform exposure in depths of colouring proportional to the original varying intensities. The same thing happens if "the sensibility of the plate is altered by the first exposure to light, and in such a manner that the greater luminous intensity corresponds to the greatest sensibility. If the varying amounts of sensibility which the surface of the plate has reached by the first exposure could be represented by depths of colouring, the various shades would represent the picture itself. With a subsequent uniform insolation, the chemical action must therefore proceed proportionally to the various amounts of light in the original picture, and, if the chemical action is made visible by a change of colour, an actual picture must be produced."

Dr. Vogel has explained this phenomenon, in a very simple manner, by the supposition that during the preliminary exposure a subsalt is formed which changes the absorptive properties of the surface and renders it sensitive to red and yellow rays.

Iodised silver plates show this phenomenon quite distinctly with deep red, yellow, or cathedral green glasses. For instance, a plate had two exposures under a graduated screen: first, a short one showing no visible image; the second, printed out to show up to 3 or 4 of the scale of 7 gradations. After some twenty minutes' exposure under the red glass, the first exposure showed a clear printed-out image up to 3 or 4 of the scale, similar to that produced by the second printed-out exposure, while this last image was fully printed out and extended under the influence of the red glass up to 7, or the full extent of the scale, the original numbers 0 to 3 being strongly bronzed, just as they would have been by a longer exposure to white light. They had, apparently, been iodised.

In the same way, an iodised silver plate exposed in white light under a scale of fifteen coloured glasses, and only showing visible action under the blue and lavender glasses, when further exposed under a red glass, showed action under all the blues and violets and bluish-greens, but not under the reds, yellows, and yellowish-greens at all, though this developing action was going on under a red glass.

Yellow and green glasses gave much the same effect. Violet glasses, either reddish or bluish in tint, did not answer at all—nor did blue glasses—the images already formed seemed to grow weaker instead of stronger, and they were removed entirely in fixing, leaving no trace.

The developing action of the red, orange, yellow, and green glasses may also be shown upon silver surfaces which have been treated with iodine, so as to show Talbot's rings, and, although there are no very marked changes in the chromatic relations of the different series of rings, there are changes which might repay further investigation. I have brought with me a series of plates illustrating the changes produced in these rings by exposure to white light, as well as to coloured light passing through glasses of various colours.

Under a red glass there is little perceptible change in the inner series of rings, but in the outer rings the blue, violet, purple, and red are almost absent, and their places taken by shades of mauve and dull green. The rings that were entirely unexposed show no change.

Under the orange glass the effect of the glass on the series of exposed rings is very similar to that produced by the red glass, but there is also a considerable developing action shown on the unexposed rings, and the scale of colouring is quite different to that shown by the exposure to white light. In the latter the outer rings are marked by a deep pansy-like bluish-purple fringed with green, while in the outer rings exposed under orange glass we have a fine, pure blue, fringed with purple, and shading out into brown.

The action of the yellow glass is similar to the orange; but, as the original exposure under white light was not carried to the green or solarisation stage, the contrast between that set of rings and those exposed under the yellow glass is not so marked, though there is a very distinct difference.

The effect of the cathedral green glass is very marked, especially in the outer rings, which show grades of pale mauve, blue, violet, and a rich bright green in the part originally exposed to white light, while the unexposed rings, though showing a considerable extension of action under the glass, are very similar to those exposed in white light, but show less red.

The blue glass shows a very marked effect, quite different to the glasses noted above. The exposed and unexposed series show practically the same effect under the blue glass, while the scale of colouring is markedly bluer, the outer rings being shown by shades of lavender or mauve working into blue-violet, and then into shades of rich blue-green, followed by a yellow-green, and then pink.

Efforts have, I believe, constantly been made to utilise this principle of after-exposure under a red glass in practical photographic work, especially in taking astronomical photographs, but the trouble is that it works best with rather insensitive plates or papers, and so there is not much saving of time. However, it might be of use in cases where large numbers of prints had to be produced from a single negative, and it would be an object to shorten the exposure required under the negative. The point to observe is that the first exposure must be sufficient to start the action in the under-exposed parts, and that the sensitive surface must be almost insensitive to the rays coming through the coloured glass. The ordinary P.O.P. paper shows the effect well.

The fact fully brought out by Bunsen and Roscoe's researches on photo-chemical induction, but first observed by Draper, that the action of light upon a mixture of chlorine and hydrogen does not take place instantaneously, but that a considerable continuation of the exposure is necessary before an action occurs, has, I think, an important bearing upon the much-vexed question of the physical or chemical nature of the latent developable image on photographic plates.

Bunsen and Roscoe found that, if the chemical rays emanating from a constant source of light be allowed to fall upon a mixture of chlorine and hydrogen which has stood for some time in the dark, no appreciable quantity of hydrochloric acid is formed during the first few moments. After some time has elapsed, a small action is observed which very gradually increases, until after a considerable space of time a permanently constant maximum is obtained. The time which elapses from the first insolation until the first traces of the photo-chemical induction become visible, and until the maximum action is attained, is, according to circumstances, extremely different.

Bunsen and Roscoe also pointed out that in their experiments they had to do with the purest form of the phenomena which are classed under the name of catalysis, freed from all foreign disturbing causes.

These researches on the action of light upon a mixture of chlorine and hydrogen have been continued by Pringsheim ("Wied. Ann Phys. u. Chem.," N.S. 32, 1887), who found that photo-chemical induction is not dependent upon the colour of the light, but only upon its chemical intensity; and it seems probable that the photo-chemical induction is based upon chemical processes connected with the formation of hydrochloric acid gas, and not upon any peculiarity in the action of light. He found also that the first visible action of light upon the gaseous mixture of hydrogen and chlorine consisted in an abruptly increasing and an equally abruptly decreasing of the volume of the gas, the amount of which was proportional to the intensity of the light producing the action. This sudden increase in the volume is brought about by a momentary dissociation of the molecules which takes place at the moment of the chemical change. Scarcely any hydrochloric acid is formed, but rather an intermediate substance. The slow formation of this acid only takes place when the mixture of gases is moist; dry gas is not sensitive except in strong light. The intermediate product which produces photo-chemical induction, and the assumption of which is completely explained by this phenomenon, arises probably from the decomposition of watery vapour. This last observation seems to have considerable importance, as Nernst has shown.

I do not know whether any series of experiments have yet been made on the basis of these researches of Bunsen and Roscoe, and Pringsheim with photographic plates. We know now that hydrogen is not a metal, as was at one time supposed, and therefore its relations with halogens might not be exactly comparable with those of silver and other metals forming light-sensitive compounds; but, from results I have obtained during the course of experiments with iodised silver plates, I believe that a carefully carried-out series of observations upon the action of light on plain silver surfaces, in combination with the halogens and mixtures of them, might yield very valuable information as to the mechanism of the latent developable image, and throw more light upon the composition of the products of reduction, which, though small in quantity, are in a form more easily amenable to chemical analysis than is the case with ordinary photographic plates prepared with collodion or gelatine.

Quite recently Dr. R. Luther has shown that, when silver is acted upon by small proportions of chlorine water added in stages, the oxidation potential, as shown by an electrometer, remained at first constant at 0.55 volt, but suddenly sprang to 1.45 volts as soon as half the silver had been combined with the chlorine corresponding to the sub-chloride Ag_2Cl. It then remained fairly constant at 1.45 volts until the whole of the silver had been converted into chloride. This action seems somewhat analogous to Pringsheim's observation of the sudden rise at the moment of chemical change between hydrogen and chlorine. Many of Bunsen and Roscoe's observations show similar sudden rises and gradual increase to a maximum.

It seems not unlikely, therefore, that for a certain time, which is variable, according to the nature of the sensitive surface and the intensity and character of the light, the action of light is physical or mechanical, and that the latent developable image is not formed till the moment when chemical decomposition begins and the stage of under-exposure is reached; a certain further period of action produces the stage of chemical decomposition, corresponding to normal exposure, and still further we reach the stages of the visible image, over-exposure and solarisation, which in some cases appears to be equivalent to electrical polarisation and reversal.

ACTION OF LIGHT UPON PURE SILVER IODIDE.

We now come to the question of the action of light upon a surface composed of pure silver iodide, such as may be obtained by completely converting the thin silver film of a silvered glass into iodide.

If we expose a piece of silvered glass to the fumes of iodine for about an hour and a half to two hours, till the silver coating is entirely converted into the anhydrous iodide, we obtain an almost transparent pale greenish-yellow film. According to some writers, this film of pure iodide is absolutely insensitive to light, either visibly or by development. I have not found it so. Visible images may be obtained by exposure in daylight, or even in the camera.

As there is no active iodine absorbent present in the film, either free silver or its compounds or organic matter, the action of light on these plates would appear to be more of a physical or mechanical nature than chemical, though, as we shall see later on, there is a very strong probability that chemical actions play their part in a somewhat obscure way.

One of these plates was exposed in the camera for seventy-five minutes upon a view of sky and houses. There was no distinct visible image, but mercury vapour brought out a faint outline of the tops of the houses against the sky, the sky being darker than the houses, &c. There were no details. The plate was left in the mercury box in the hope of bringing up more, but the image gradually disappeared, and eventually did so completely, leaving absolutely no trace. The same thing happened, though not so completely, on another plate exposed in the same way, but showing a distinct visible image after exposure in the camera, and also developed with mercury. A similar vanishing of a developed image was also noticed on one of the silvered glass plates, which was exposed for some days from the glass side. There was no visible image on that side, but there was an image on the unexposed face of the glass, which could be brought out by breathing. On developing the plate with acid iron and silver, and forcing it a little, traces of the image were distinctly visible from the glass side of the film; but, after the film dried, all traces of the image had disappeared from that side as well as from the front. From these two instances there seems to be some ground for believing that photographic images may be produced by purely molecular action.

On exposing another of these super-iodised plates for five minutes in the sun under a screen of fifteen coloured glasses, I noticed that where the light acted through the blue, violet, and bluish-green glasses, the film appeared more or less opaque and clouded, whilst the edges of the plate, which were freely exposed to the sun the whole time, were only very slightly darkened or different to the unexposed ground. On developing with mercury the vapour was deposited on all the affected spaces under the coloured glasses, but not on the protected parts or the unaffected spaces under the red, yellow, and green glasses, nor on the over-exposed and solarised parts outside. Development with acid iron and silver gave precisely similar results, as you will see from these two plates. The images in both cases are rather thin.

This peculiar turbidity or opacity of the fully iodised silver film when exposed to light was noticed by Schultz-Sellack "Photo. Mitth.," 1871, p. 60; or "Photo News," 1871, p. 308). He says that the action of light is sometimes shown by the production of a series of colours in the film when viewed by transmitted light, by refraction of the light through the particles of iodide of silver. I have not noticed these variations of colour.

He further says: "If different parts of a plate are exposed to the action of light for various periods, covering portions partially with an opaque shield, which is drawn away after certain fixed periods of time, it will be observed that the action is apparent only after the lapse of a certain time, and it suddenly increases with great rapidity. To start the action in the first instance, therefore, a certain amount of light is necessary." This, it seems to me, furnishes a practical corroboration of Bunsen and Roscoe's theory of photo-chemical induction, and may be compared also with Luther's recent observations, previously referred to.

According to Schultz-Sellack, the presence of a small quantity of free iodine is necessary to the occurrence of the mechanical change; by keeping some time in the air or by treatment with iodine absorbents, the sensitiveness of the material to mechanical change is annulled, but again restored by further fumigation with iodine. In my own experience I have not noticed any very marked difference of action between plates that have been left in the air before use or fresh ones still charged with iodine, though the latter are, I agree, more sensitive, *i.e.*, more quickly affected by light than the former. If a plate has, however, been exposed to light in contact with an iodine absorbent—silver, copper, or tannin—then, although there is a decided darkening visible by transmitted light, the film does not become opaque.

If, again, as suggested by Schultz-Sellack, one of those over-iodised plates is partly coated with collodion or varnish, then we notice a very marked difference between the images produced on the varnished and unvarnished parts. This is very clearly shown in the prints of a graduated scale I have here. On the unvarnished half we have a strong series of pale whitish-yellow bands decreasing very distinctly in density, while on the varnished half, though exposed longer, the images of the bands, though visible, are all more or less phantoms. It must be noted, however, that the varnish is a strong iodine absorbent, which collodion might not be.

Schultz-Sellack found that somewhat similar effects could be produced with films of pure iodide of silver in collodion fumed with iodine. He attributes the changes of colour which are observed to a mechanical change in the particles, and not a chemical change.

In a paper published last June in "Wiedemann's Annalen," H. Scholl has very fully investigated the changes produced by the action of light on silver iodide and Daguerreotype plates. In the third section he gives the results of his inquiries into the cause of this peculiar turbidity. He first shows that, as we have already seen, if the film of pure silver iodide produced as described is covered over by a coating of varnish, collodion, or some other suitable substance, the cloudiness is produced very much more slowly. This may be due either to the coating preventing the escape of iodine or the access of air. If any iodine is given off during exposure, we ought to be able to detect it by placing the iodised film in contact with a plain silvered glass surface. On doing this he found that there was some change on the silvered surface, but not more than could be observed by exposing the silver to a light of the same intensity, but not in presence of the silver iodide. There were no distinct interference colours, and he does not consider the experiment convincing.

I have tried this experiment several times in different ways, and find that the plain silver surface is very distinctly and even visibly affected by contact with the iodised plate during exposure, and certainly very much more so than if exposed by itself under the same circumstances. For instance, a slip of pure silver foil was exposed for fifteen minutes in the sun under one of these iodised silvered glass films, but separated from it by a cut-out screen of mica. The silver foil showed distinct images of the cut-out designs, which darkened still further when exposed to light, and were quite soluble in a solution of potassium iodide. The parts of the foil protected by the mica were quite unaffected. Similar results were obtained with polished copper and with paper soaked in tannin, the images in the latter case being brought out with weak aceto-nitrate of silver.

There is little doubt, therefore, that iodine was given off under the influence of light in presence of an iodine absorbent. It may be noted that, in all these cases, the parts of the iodised silvered glass that had been in contact with the iodine absorbent surfaces were transparent, while those in contact with the mica showed distinct cloudiness or opacity, though enclosed and protected from the air.

Scholl then argues that, if the clouding be due to loss of iodine during exposure, it ought to be less or disappear altogether if the plate is exposed in the vapour of iodine. He found, however, that, on the contrary, the plate clouded much more readily under exposure to light in the iodine vapour than it did in the air. The opacity, therefore, is not due to loss of iodine, and the action of the collodion or varnish in hindering it must be due to its preventing the access of air to the film. The change in the iodide must consequently depend upon the nature of the gases in which the plate lies during exposure.

[The occurrence of the clouding in the cases above noted, when the iodised films were exposed in contact with mica, may, I think, be explained on Scholl's theory by the iodine being first given off and then resensitising the film, as if it had been exposed in the vapour of iodine.]

Experiment showed that hydrogen and nitrogen had absolutely no effect in producing the opacity. In oxygen, however, it was produced rather more quickly than in air, and it was evident that oxygen is the active agent in the change.

This being the case, the first question was whether any oxygen compound of silver and iodine is formed—such as silver oxide, iodate of silver, or silver oxyiodide? It was found, however, that the clouded film remained perfectly unchanged in ammonia, and no trace of chloride could be obtained by adding hydrochloric acid. Moreover, the opacity could be produced in the complete absence of oxygen in an atmosphere of hydrogen, which, as we have seen, favours it. In this case the opacity occurred distinctly more quickly than it did in air with the same exposure.

If no oxygen compound is formed, Scholl says, we can only conclude that pure silver iodide is present. That this is the case may be shown by heating an exposed plate which is strongly opaque in parts; both the clear and opaque parts turn of a clear deep yellow, which is characteristic of the change from the hexagonal system of crystallisation to the regular at temperatures over 146° C. (In repating this experiment I find that the deep yellow colour produced by heating goes off again at once as the plate cools. This is exactly analogous to the deepening of colour of pure iodide in the light, and the return to the original colour I have already noticed.)

In fixing solutions of sodium thiosulphate or potassium cyanide, the film dissolves equally in the unexposed transparent and exposed opaque parts. (The action of sodium thiosulphate is to make the unexposed parts of the film opaque, just like the exposed parts. Potassium iodide has a somewhat similar effect, ammonium sulphocyanide also, but it seems to dissolve the exposed opaque parts less readily than the transparent parts.)

From these experiments Scholl says we may conclude that the opaque film is formed of pure, mechanically divided silver iodide, and that oxygen plays a catalytic part in advancing the formation of an intermediate substance. He considers the reactions caused by the exposure of the silver iodide to be somewhat as follows:—

According to Arrhenius, silver iodide exposed to light is dissociated and its stability strongly affected. For complete decomposition, a substance must be present which can combine either with silver or iodine. In the foregoing case, the silver forms, with the oxygen in the air, a compound, possibly Ag_2O, and the silver iodide will be more easily decomposed by the presence of oxygen. This silver oxide must be again decomposed by light, and the silver set free again forms silver iodide with the free iodine, whereupon the same process can begin all over again.

$$2AgI+O=Ag_2O+2I=2AgI+O=\&c.$$

In this way there must be a continual transference of atoms, which, no doubt, is connected with the loosening and clouding of the whole film.

It is unimportant whether Ag_2O itself or another body easily decomposed in light is formed; the essential point is that oxygen, by forming a compound, favours the complete decomposition of the already dissociated silver iodide, and then there is an immediate return to the original state, and a new formation of the silver iodide originally present.

Iodine must evidently, therefore, act more strongly than oxygen. On account of the greater affinity of silver for iodine than for oxygen, a compound which can be split up by oxygen must be decomposed much more readily by iodine. It is thus easy to understand why the opacity takes place so much more readily the greater the excess of iodine the plate exposed to air contains.

The fact that the images produced by the exposure of this pure iodide to light can be developed by mercury vapour or by silver deposited from an acid pyrogallol developer does not require, according to Scholl, to be attributed to a chemical change in the exposed film, but rather to the roughness of the surface caused by the breaking up of the film in the exposed parts, the rough surface more readily taking the mercury and silver. This agrees with my own observations, but I do not think it applies in all cases.

I have gone somewhat fully into these observations of Scholl's in order to make them clear. Whether his theory is correct I cannot say; but that oxygen, taken either from the surrounding air or from the watery vapour which is always more or less present in it, does play an active part in the decomposition of silver haloids in light, has been proved by H. B. Baker ("Trans. Chem. Soc." 61, 1892, 728.)

From experiments recorded in the "Researches on Light," Hunt came to the conclusion that the first action of the solar ray is to liberate one-half of the combined halogen (chlorine in the cases recorded, but the conclusions apply equally to iodine and bromine), which is very readily, moisture being present, replaced by oxygen. This absorption of oxygen or its combination with the decomposing chloride he proved by placing some pure silver chloride in a bent tube closed at one end while the other was immersed in distlled water. After some days' exposure the water rose in the tube and contained chlorine, which was shown by the usual precipitate with silver nitrate.

That water is decomposed by the action of light on silver iodide is, I think, shown by the following simple experiment. Some of the brick-red powder of anhydrous super-iodised iodide was placed in a tube with distilled water, and then exposed in the sun. After a time it was found covered with little bubbles of gas, most probably oxygen. The iodide became paler in colour, though not lemon yellow, and the supernatant watery fluid gave a slight cloudiness to a solution of silver nitrate. By remaining longer in the water the pale yellow iodide was formed.

Similar little bubbles of gas were observed when precipitated silver was treated with iodine in distilled water and exposed to the sun.

Captain Abney has recorded a similar experiment in which silver iodide was placed in a test tube with a boiled solution of silver nitrate. On exposure to light, bubbles of gas were found collecting in the solid iodide, and proved to be oxygen. From which, he says, we may suppose that the liberated iodine decomposes the water in contact with it (as does chlorine) and produces hydriodic acid and oxygen.

Professor Meldola has also gone into this question in his "Chemistry of Photography," and seems to think that an oxychloride may be formed by the decomposition of silver chloride by light in presence of watery vapour. This view is confirmed by Baker's recent work, already referred to. From the appearance of the substance produced by the union of silver and iodine under water, and its peculiar olive green colour, it is possible that it may be an oxyiodide or a subiodide, and it may be worth more careful examination than I have been able to give it.

In an earlier part of the lecture it was stated that iodine has a very much greater affinity for oxygen than the other halogens have, and so it seems not unlikely that oxygen may produce more marked effects upon iodised silver plates by the action of light than it does with the chloride or bromide.

I have noticed other effects in the opaque parts of these films which seem to be due to the formation of some gaseous product, but further observation is necessary; the tearing up of the film can, however, be readily seen on two plates I have here. Another plate exposed in contact with a gelatine film negative does not show it, but rather a great increase of density.

That there is an evolution of a gaseous product during the exposure to light in contact with air of these superiodised plates is demonstrated by the blister-like appearance visible in the exposed parts. Moreover, on exposing one of these films in contact with a silvered glass plate not only was the surface of the silver darkened in the parts exposed to light through the iodised film, but minute black spots were produced on the silver corresponding exactly with the blisters, as you will see. The composition of the dark spots remains to be seen, but they were most probably caused by iodine expanding and bursting through the film. This effect has not been noticed by Scholl.

If Scholl's theory of the catalytic action of oxygen be correct, and this action takes place when haloid salts of silver are exposed to light, even without the presence of organic matter, it will probably also take place, but in a much greater degree, when organic matter is present. When oxidation takes place in presence of water or watery vapour Schonbein has shown that peroxide of hydrogen is formed, and, more recently, Sonstat has treated its presence, when chloride of silver is exposed to sunshine in water ("Proc. Chem. Soc." 14, 1898, 179). This substance, as we know from Dr. W. J. Russell's recent researches, is capable, even in very small quantities, of producing the developable state of the haloid salts of silver on an ordinary gelatine dry plate. In this way, therefore, we may possibly be able to trace the connexion between the effects produced by peroxide of hydrogen vapour and by light upon the haloid salts of silver. Further investigation is, however, required.

I hoped to have been able to say something with regard to the action of light upon the ordinary Daguerreotype plate, and had intended to almost confine myself to the question of the probable nature of the latent and printed-out images upon iodised silver, but, as I went on and my attention was diverted to the points I have brought before you, I have not been able to complete the work I began. I propose, therefore, to close my lecture here and defer further consideration of the question till I can work it out at leisure and give the results to the Society in a supplementary paper.

The points I have dealt with are none of them new, but are, I think, of some interest generally, and I hope I may have been able to throw light upon them and carry on the work of my predecessors.

PHOTOGRAPHY IN WEAVING.

The following description of Herr Jan Szczepanik's latest application of photography for the preparation of the pattern cards for the Jacquard machine for weaving, was given by him before the Vienna Photographic Society, and reported in the "Photographische Correspondenz":—

A material is a combination of two systems of threads which cross one another at right angles. The threads of one system run parallel to one another in the direction of the length of the fabric; they form the warp, and in weaving they must be stretched on the loom in the desired number and of equal length close to one another. The other system of the threads is of the woof or weft, which, in the simplest cases, is one thread which runs in the breadth of the material once from left to right, then from right to left without break, between the threads of the warp, and crosses the same according to a desired plan. In order to obtain the crossing, part of the warp threads are raised and part allowed to lie flat, and through the lease or shed thus formed the weft is thrown by means of the shuttle. The lifting of the warp threads is effected in the Jacquard machine by means of perforated cards. These cards represent the various crossings which are formed in weaving and make the pattern. If we assume the warp to be white and the weft black, there is formed, if the crossing takes place regularly, and, for instance, if one thread is lifted and the other lowered, a fabric, the crossing of which, if enlarged, will

Fig. 1.

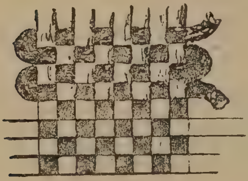
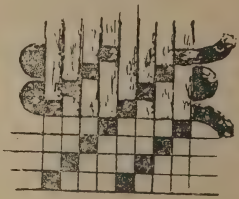


Fig. 2.



appear as in fig. 1. This crossing is called taffeta-wove, and in the technical drawings or patterns, which are necessary for the preparation of the perforated, so-called Jacquard cards, this combination will be drawn as shown in the lower part of fig. 1. Figs. 2 and 3 represent other methods, the so-called four-thread twill and eight-thread satin. In fig. 3 there will be even fewer black points than in fig. 1, and the material will be bright, almost white; fig. 1, on the other hand, appears rather

FIG. 3.

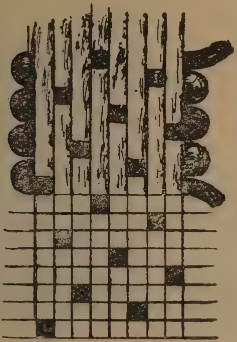
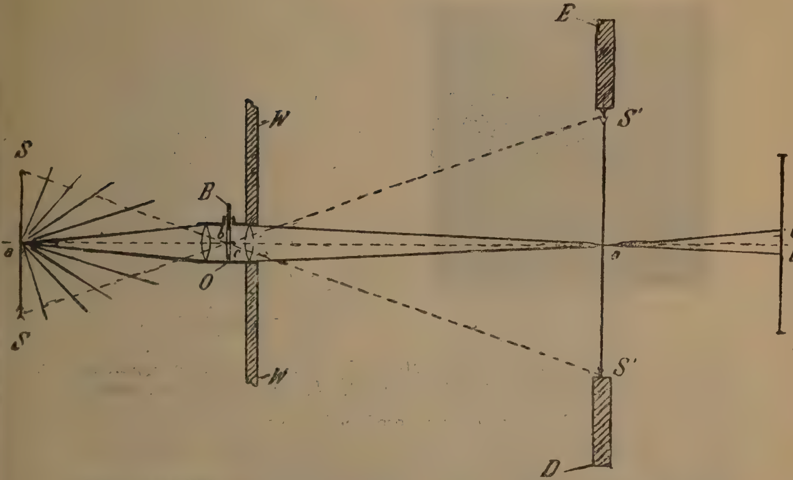


FIG. 4



dark. Without the points of intersection there would be, in the ground, and also in the figure, close to one another, long loose threads, and this is obviated in weaving by choosing for the ground and the figure different points of intersection corresponding with the pattern. The crossing has the effect, not only for the purpose, of fastening by warp or weft loose threads, but also for marking tone effects.

Fig. 5.

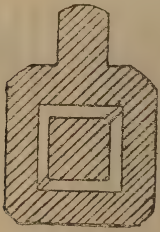
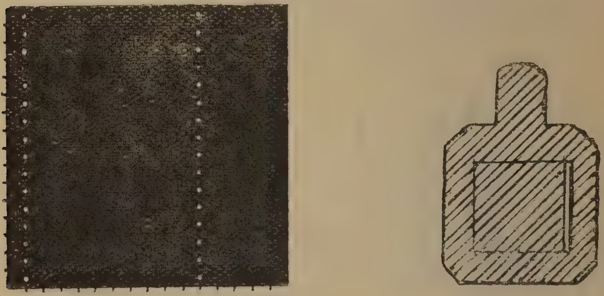


Fig. 6



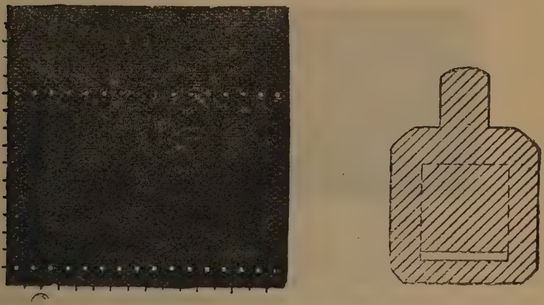
a Schenienplatte. *b* Blende hierzu.

If it is desired to prepare any pattern in material, various crossings must be made visible, thus: for the ground, fig. 3; for the ornament, fig. 1.

Herr Szczepanik has succeeded in producing the pattern cards, which are made one metre square and over, by photography, and to prepare in a few minutes what previously took weeks and months. The whole process has by this means become purely mechanical.

The fundamental principle underlying this process is the action of the diaphragm of a photographic lens through a perforated plate (fig. 4). In this figure, s s represents a negative, o is the lens fastened in the wall of the dark room, s^1 s^1 the projected enlarged image. Every point of the object to be copied, in this case is a, sends the rays in all directions, and those which reach the objective form a pyramid of rays, in this case $a\ b\ c$. The rays of this pyramid are so refracted by the lens that they combine at the other side of the lens a^1. Behind the lens there is, therefore, the pyramid, $a^1\ b\ c$. Both pyramids have different heights,

FIG. 7.



a Schenienplatte. *b* Blende hierzu.

but the same base, $b\ c$, which is dependent on the shape of the diaphragm between the lens. If the bundle of rays is now intersected with a ground glass or a light-sensitive paper in the plane, M M, there is formed a base of the pyramid, which is equal to the base, $b\ c$, common to the two pyramids, $a\ b\ c$ and $a^1\ b\ c$, and therefore equal to the diaphragm.

With this new system an enlarging apparatus is combined with a line plate. If a square diaphragm be placed in the objective of the enlarging

FIG. 8.

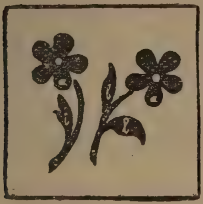
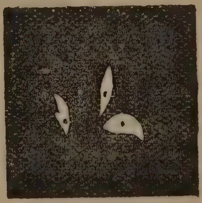


FIG. 9.



apparatus, and the lantern be lit, the image of this square is formed behind each aperture on the ground glass, and, by pushing this to and fro behind the perforated plate, these squares may be made to close up to one another, so that the whole surface of the ground glass or the paper appears in squares or check-patterned. If it is desired to produce a stronger lining, a covering plate is placed in front of the perforated plate so that it covers completely a number of the squares, which shall be distributed according to the paper which is to serve as a pattern. It is only necessary to place in the lens a diaphragm like fig. 6 or 7, but with a rather broader slit than in the squaring stop used in the first place.

FIG. 10.

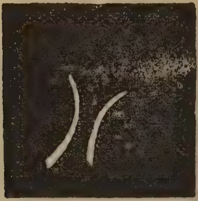
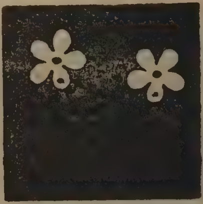
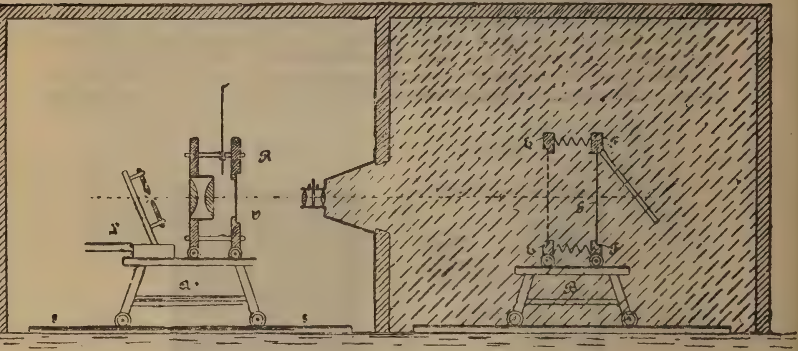


FIG. 11.



Up to now the lens has been focussed on a ground-glass screen, s' s'. If in front of the ground glass is placed the negative of the model which is to serve as a pattern, and projects this negative, enlarged, on to the perforated plate, the rays of light which pass through the transparent parts of the negative will also go through the perforated plate, and simultaneously give the image of the diaphragm, B (fig. 4), on the matt screen.

FIG. 12.



For preparing the enlarged pattern from the negative, a paper sensitive to light is placed in the place of the ground glass. The diaphragm which is destined to cause the squaring of the image is placed in the lens and exposed without the negative. There is thus obtained that check paper which is known commercially as "Cartarigatta Papier."

The image of the subject is now projected on to the check, and impressed in the same way by placing the negative in the lantern and using the corresponding square stop in the exposure of the negative. If in the ground, or in different parts of the figure, various points of intersection are to be made, the process is carried out as follows:—

From the subject one transparency (fig. 8) and up to four negatives 6 × 9 cm. are prepared, then there are as many parts of the negative covered so that on every plate only those places shall be transparent as shall have the same crossing (figs. 9, 10, 11). These plates are projected one after another, by means of a lantern (fig. 12) through the perforated plate, E E, behind which a glass plate, F F, is placed for holding the silver bromide paper. If, for instance, the negative (fig. 11) is sharply projected on to the perforated plate with a square stop, there appears, on the gelatino-bromide paper or the ground glass the whole figure in squares. If an aperture of the perforated plate is illuminated, it gives the whole shape of the diaphragm; thus the whole square, by this means the graduated outline is explained.

Fig. 13

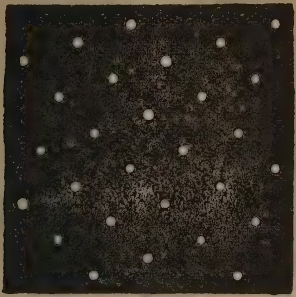
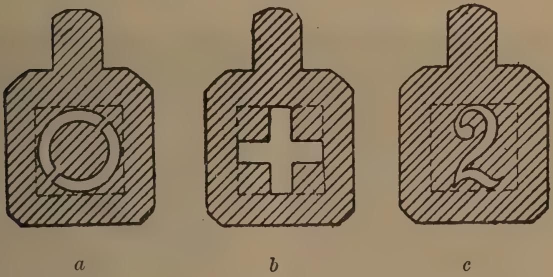


Fig. 14.


a *b* *c*

The crossings are so effected that certain points on the perforated plate are covered by the so-called crossing plate (fig. 13). To make the patterns about 30 such plates are required. Different negatives or positives with different crossing plates can be used one after another, and thus prepare a pattern with various crossings. The squares on the ground are produced by the transparency and the diaphragm (fig. 5).

FIG. 15.

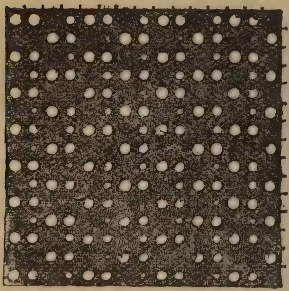
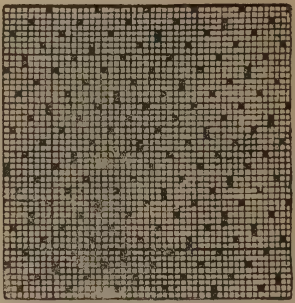


FIG. 16.



Obviously, if in the figures certain crossings must appear, instead of the negative, must congruent transparencies produced from the same be inserted, and for this purpose special stencil frames are used, by means of which the transparency can be placed in the exact position of the negative.

If, in different figures of one and the same pattern, various crossings should appear in colours, so must, on the negative or transparency, those

FIG. 17.

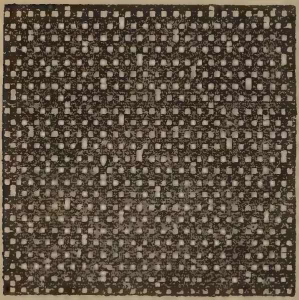
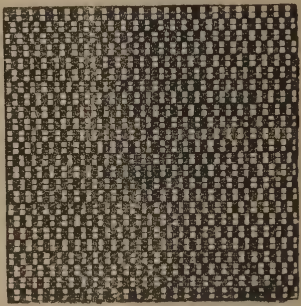
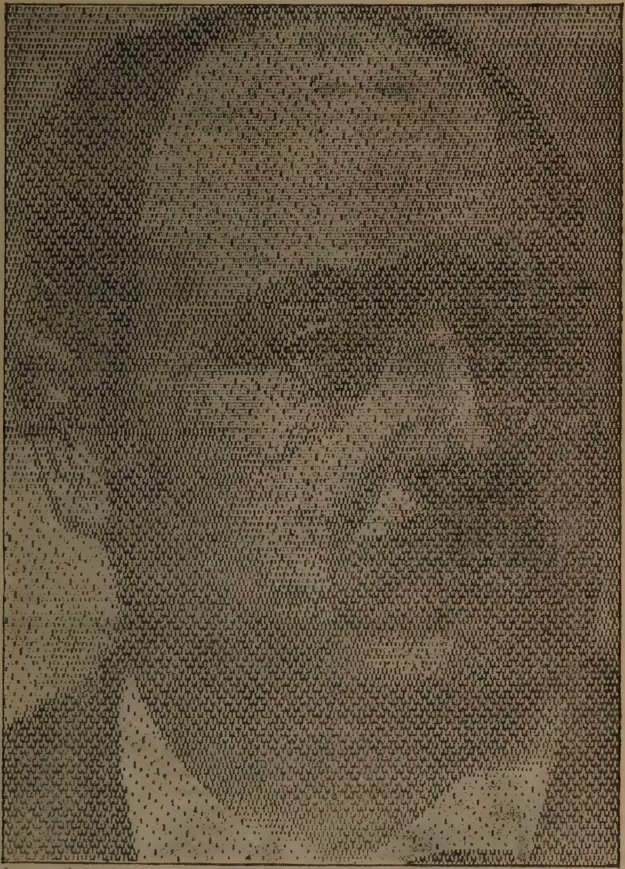


FIG. 18.



surfaces be covered in which these crossings are not to appear. If, therefore, various colours are to be apparent on the same pattern, so must analogously these places be transparent in the negative or positive according to the ground or figure which must carry these colours. Certain

FIG. 19.



diaphragms can be chosen for certain figures, which can be done by means of such diaphragms as fig. 14 (*a b c*).

For shaded ornaments a plate (fig. 15) is used which consists of various-sized openings, which form the crossings, is called a shading plate. As every opening is a pinhole camera, the larger diaphragm openings will always print in a shorter. If such a plate is exposed for a very short time, only the very large prints can be impressed, and we obtain fig. 16; with longer exposure, we get fig. 17; with an exposure of one minute, all apertures will be impressed (fig. 18). If, instead of different exposures, a negative is placed in front of the lens, and this exposed through a perforated plate on gelatino-bromide paper for a certain time, the brighter portions print more squares than the less transparent. A portrait appears as in fig. 19. The various-sized points of the perforated plate are placed according to certain rules, which correspond to those of weaving. This work far exceeds hand work as regards plasticity, as the preparation of lights and shades by crossing is extremely difficult.

The first experiment, according to this process, was the preparation of a pattern for a silk tapestry, 148 × 120 cm. The patterns used were 176 cm. square, and prepared in six hours, and a pattern-cutter, who could scarcely obtain the same effect by hand work, requires several years.

It should be mentioned that the inventor is now busy in the preparation of fabrics in natural colours on the basis of trichromatic printing. The principle is as follows: Three negatives are prepared from the picture to be woven, similar to those for trichromatic printing, but without the cross-lined screen, and these were so used, with particular shading and covering plates, that for each negative another line was printed. Such a pattern card represented the colour intensities in points of intersection, in which every first line represented the red, every second the yellow, and every third the blue. This naturally recalls the well-known Joly process. If there is in the fabric, that is to say as warp, close to one another in the same order, a red, a yellow, and a blue thread, and these patterns are woven through, there is formed a picture in natural colours. The delicacy of the reproduction depends upon the fineness and thickness of the threads.

Szczepanik's experiments in this direction, with 180 threads to the square centimetre, gave beautiful results, but the colours were somewhat too bright. In weaving in natural colours one does not meet with any of the difficulties of trichromatic printing, since all the colour lines must run parallel, and consequently the superposition of the colours or non-coincidence of the same is completely excluded.

ON TONING BROMIDE PRINTS AND LANTERN SLIDES WITH COPPER COMPOUNDS.

[Abstract from a paper read before the Royal Photographic Society.]

By W. B. Ferguson, Q.C., M.A.

I shall give an account of experiments, begun in 1895 and continued until quite recently, with a view of finding out the best process of toning with copper salts, and I think it will be useful if I shortly indicate my failures as well as my successes. Experimental work of this kind is like exploring a new country; it saves trouble to those who follow us if we indicate those roads which we have tried and find ourselves unable to follow, as well as those paths which lead to success.

The materials which I selected to work on are ferricyanide of potassium K_3Fe $(CN_{/6}$, and cupric sulphate, $CuSO_4 + 5Aq$. The choice of cupric sulphate is not only due to the fact that it is cheap and easily obtainable, but it is also due to the fact that it is a stable salt without oxidising or reducing action on the other re-agents employed. Copper nitrate is a strong oxidiser and would re-act on the ferrocyanide; and copper chloride, in the presence of such an oxidising agent as potassium ferricyanide, would form a chloride of silver, and bleach the film.

The easiest way of using the compounds referred to is to make 10 per cent. solutions of each, and then to measure out by means of a graduated test glass the quantities of each required. Measuring the volume of liquids is much easier and more accurate than the weighing and dissolution of small quantities of solid salts.

The first thing I set myself to do was to make ferricyanide of copper. If you act with ferricyanide of potassium on sulphate of copper, you get ferricyanide of copper and sulphate of potassium. If you want to find out the quantities, write out the equation representing the decomposition, and put underneath it the combining weights of the quantities used, thus:—

$$\begin{array}{l} 3\ (CuSO_4\ 5H_2O) + K_6Fe_2\ (CN)_{12} = \\ 3 \times 249{\cdot}5 \quad + 658{\cdot} \\ 3\ K_2SO_4 + Cu_3\ Fe_2\ (CN)_{12} + \text{water.} \end{array}$$

That is to say, 748.5 parts of copper sulphate combine with 658 parts of potassium ferricyanide to form cupric ferricyanide, potassium sulphate, and water. If, therefore, using our 10 per cent. solutions, we add 75 c. c. of the copper solution to 66 c. c. of the potassium ferricyanide solution, we may expect to get a precipitate of cupric ferricyanide in a solution destitute both of free cyanide and free copper sulphate. In this way a dense, flocculent, greenish-yellow precipitate is obtained, which is our ferricyanide of copper. It is necessary, however, to get rid of the potassium sulphate. The precipitate is too fine to filter, and it subsides very slowly unless the copper sulphate be in excess, but it can be washed by decantation in the following way:—The mixed muddy solution is put into a hock bottle (for the cupric ferricyanide is sensitive to light), and the height which it reaches in the bottle is marked with a label; the bottle is then filled up with water and allowed to rest; when the precipitate falls to the mark in two or three days, the clear liquid above is syphoned off, and the process repeated several times. In this way most of the potassium sulphate is got rid of, and a sort of emulsion of copper ferricyanide in water remains.

The next thing is to find a solvent for this ferricyanide of copper, which will make a solution from which the finely divided silver of the photographic image will reduce the copper as ferrocyanide; and the solvent must be such that the solution so formed will neither destroy the gelatine or paper, nor enter into such action with paper or gelatine as will produce stain. The first experiments gave the following results:

1. Ammonia dissolves the muddy emulsion of copper ferricyanide to a clear green solution, which tones plates and paper rapidly, but stains both the paper and the gelatine so that the picture resembles a red chalk drawing on a red wall. The fact is that an ammoniacal solution of copper dissolves the cellulose of the paper, and this solution of cellulose will itself reduce a ferricyanide; gelatine also, in solution, has the power of reducing ammoniated ferricyanide of copper, and is itself coagulated by it. Another point is that the red ferrocyanide of copper is itself soluble to a large extent in the ammonia, and the solution so permeates the paper that it is impossible to get rid of it, and a brownish-red stain results.

2. The next substance tried was a 10 per cent. solution of ammonium carbonate. This dissolved the ferricyanide of copper and gave a toning solution better than the caustic ammonia, but still stained paper prints

to such an extent as to render it useless, though gelatine was affected in a less degree. The slides and prints could to some extent be cleared with a 2 per cent. solution of ammonia and washing; but neither in my experience nor in that of other workers can the stain be entirely removed. The stain is not sufficient to prevent this mixture being used as an intensifier, but negatives so intensified are very slow printers.

3. I next tried carbonate of potash, which is very similar to the carbonate of ammonium in its action. It gives on plates and paper a surface stain partly removable by rubbing with a pledget of cotton wool, and which is probably due in part to the precipitation of carbonate of lime from the water, and in part to the fact that both paper and gelatine are acted on by ferricyanides in alkaline solution.

4. Nitrate of ammonium, unless made alkaline, will not dissolve the ferricyanide of copper, and when made alkaline it stains badly.

5. The use of neutral oxalate of potassium in the platinotype process suggested its trial as a solvent. It forms with the ferricyanide of copper a green solution, which, if used as soon as made, tones both plates and paper with considerable success, as will be seen from the specimens now shown, which were toned in 1897.

In the process as then worked there were some drawbacks. (*a*) It was necessary to get rid of all traces of hypo, which was best done by treating plates and prints for a minute with a 1 per cent. solution of hydrochloric acid rendered faintly pink with permanganate of potash; this, of course, necessitated a second washing. (*b*) A slight staining of the whites took place unless a very pure water, free from lime, could be used; the oxalate of lime formed during the process was deposited in and on the paper, and carried with it some of the cupric ferrocyanide which veiled the slides and paper; some could be removed by rubbing with a pledget of cotton wool, and the rest by treatment with dilute hydrochloric acid, which involved a further washing and a tendering of the film. (*c*) Another drawback was that the toning solution produced as above or by mixing of proper quantities of potass. oxalate, potass. ferricyanide, and cupric sulphate soon decomposed; though clear at first, it soon became muddy and deposited in turn neutral oxalate of copper, crystalline needles of potassio-cupric oxalate and oxalate of lime; and unless the toning is done at once and the dish well rocked, these crystalline particles lead to marking of the film. (*d*) The length of time employed was great, over an hour being required to get a fairly reddish tone.

These drawbacks led me to try and find a more suitable solvent. Phosphate of soda, acetate of soda, acetate of potash and neutral tartrate of soda were found useless as not being solvents. I then went back to ammonia and tried ammonium citrate, which promised to be a good solvent. The cupric ferricyanide is soluble in four volumes of the 10 per cent. solution of ammonium citrate, or a toning solution may preferably be formed by adding eight volumes of ammonium citrate solution to one volume of copper sulphate solution, and, after mixing, adding 6-7 volume of potassium ferricyanide solution, which causes no precipitation. Toning solutions made in this way act very well with slides, but as with all ammonia-copper compounds and ferricyanides in alkaline solution the paper and prints are stained.

Citrates having, apparently, a favourable place in copper toning, I tried to use citrate of copper and decompose it with ferricyanide of potassium, but owing to the cupric citrate obtainable in the market being almost insoluble in water and citric acid, and only very slightly soluble in potassic citrate, it was of no practical use.

In neutral potassic citrate I found a substance which acts as an excellent solvent of the cupric ferricyanide. One volume cupric ferricyanide "mud" was dissolved in four volumes of a 10 per cent. solution of potassic citrate, and formed a solution which toned a lantern slide to a red colour, without stain, in three minutes. A better method still, however, is to mix the neutral potassic citrate with the copper sulphate, and then add the potassium ferricyanide, the whole forming an emerald-green solution which tones both plates and paper, without stain, with tints varying from purple-black to cherry-red, according to the time of immersion.

I show you a series of lantern slides and prints toned to different colours, within the limits mentioned, the pictures being removed from the toning solution when the desired tint has been reached; and I will demonstrate the process by toning some bromide prints in a solution made as follows:—

75 c. c. of a 10 per cent. solution of CuSO4
are mixed with
570 c. c. of a 10 per cent. solution of neutral pot. citrate,
and then there are added
66 c. c. of a 10 per cent. solution of potassium ferricyanide.

The solution is clear, will keep, and will not stain either plates or papers.

[The solution was then made up and prints and lantern slides were toned with it to various colours.]

Tartaric acid added to copper sulphate and then neutralised with sodium carbonate gave a clear solution, and upon adding potassium ferricyanide a toning solution was formed which toned slowly, stained but little, and gave a brown colour.

I may add that bromide prints toned by the oxalate process are capable of being afterwards treated with ammonium sulphide, by which means some very pleasing tones may be obtained. It is curious that copper toned prints produced by the citrate method are not amenable to this treatment.

SOME PATENTED INVENTIONS OF THE YEAR.

Selected and condensed by the Editor.

GELATINE RELIEFS.

The invention of Messrs. Heimsoeth and Co., of Cologne:

A plate of plate glass is covered with a sensitive film of gelatine, and exposed under a negative or a positive, and the gelatine film converted by washing into a relief, this last mentioned relief forming the printing mould.

In order that the gelatine ink may not remain adhering to the mould, it must be saturated in a suitable manner with oil or grease. As the relief completely soaked with water would repel the oil or grease, and at the same time care must be taken not to conceal the finer details, only a decomposed layer of oil or grease must be put on. This must be so effected that the gelatine, which is not very resistant, may be preserved against pressure or friction.

The relief is, therefore, for a certain time, placed in a bath consisting of a solution of soap and water, and then in a ten per cent. solution of chromate of alum or of an acid. The soap in the gelatine film will be hereby decomposed and the gelatine completely saturated therewith. On the surface a scarcely perceptible trace of grease will remain, which, however, owing to its consistency, separates the gelatine ink from the relief completely. By a further treatment with oil the residue of grease can be strengthened.

In printing processes with metal, resin, or other hard moulds, the latter hitherto had to be vigorously rubbed with oil with a flannel rag. This rubbing in of oil had to be repeated after every printing; consequently the delicate outlines of the relief were dulled by the frequent rubbing, and the prints wanting in sharpness. In the present process the mould is steeped with oil, and this oiling needs only to be repeated after a considerable number of printings. As the moulds are not continuously rubbed with oil, they last longer than those formerly used and made of metal.

As the relief is formed directly on a plate of plate glass, and remains thereon during the printing, a permanent evenness is ensured in the moulds, and thereby a novel, rapid, and inexpensive method of printing from gelatine moulds created, as hitherto it has not been known that reliefs in gelatine could be employed for this purpose.

DALLMEYER'S IMPROVEMENTS IN PHOTOGRAPHIC LENSES.

[Patent No. 24,720 of 1899.]

The inventor's object in particular is to assist the user of the "hand camera," and the smaller sizes of cameras, to avoid "exaggerated" perspective by enabling the operator to be at a greater distance from the foreground of his subject, and yet maintain a sufficiently large image; also to obtain, by the addition of the enlarging system to his lens, enlarged details in subjects of general interest included by the ordinary lens used alone; distant objects, &c.

"The invention may, nevertheless, be applied to any ordinary lens to attain the ends of a tele-photographic system with greater mechanical convenience; the additional system to screw into the place of the 'hood' of the lens.

"A is an ordinary photographic lens, and B and C are the lenses making up the enlarging system. B and C are mounted in tubes, D and E, sliding one within the other, so that the distances apart of B and C can be varied, as shown in figs. 1, 2, and 3. Fig. 4 is similarly constructed, but it has not been thought necessary to show more than one position.

"The lens, B, should be of the highest intensity possible, that is to say, of the largest diameter and shortest focal length convenient; so that, when combined with C for a given linear magnification, the initial intensity of the lens, A, to which it is added, may be maintained, or at any rate diminished in a less degree than would be the case with any posterior attachment to the original converging lens, A.

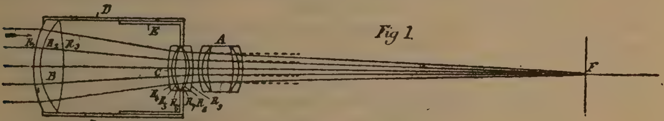


Fig 1.

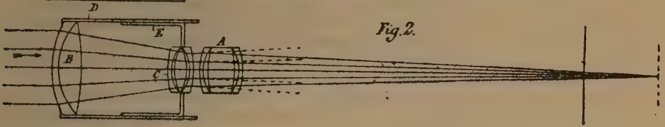


Fig. 2.

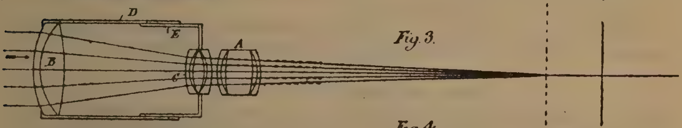
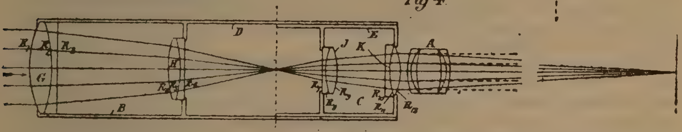


Fig. 3.

Fig 4.



D
E
J
K
A
G
H
B
C
R_1 R_2 R_3 R_4 R_5 R_6 R_7 R_8 R_9 R_{10} R_{11} R_{12}

"The lens, C, should be of shorter focal length than that of the lens, A, again maintaining the largest diameter and shortest focal length possible, so as to maintain, in combination with B, the initial intensity for a given linear magnification when this is feasible.

"The power of the diverging lens, C (figs. 1, 2, and 3), should preferably be equal to or greater than the sum of the powers of the converging lenses, A and B.

"According to the degree of magnification required, I decide the ratio of the focal length of B to that of C.

"When the lenses, B and C, are placed at the normal separation, that is, at a distance equal to the difference of their focal lengths as shown in fig. 1, parallel rays incident upon B will, after refraction at C, emerge parallel. Now, if we place this supplementary system in front of any ordinary lens, A, which has been focussed for parallel rays (forming an image at F in its focal plane), it is obvious that the addition of this system, which transmits parallel rays, will not alter the plane of the focus, but will increase the linear dimensions of the image in a ratio equal to the ratio of the focal lengths of B and C.

"If the effective diameter of the aperture of the lens, B, is greater than that of A, it is evident that the loss of illumination due to magnification may be compensated for partially or entirely.

"If the ratio of the effective diameters of B and A is equal to the ratio of the focal lengths of B and C, the illumination is identical; if less, the illumination is diminished, supposing always that the full pencil of rays incident upon B is transmitted by C, which can be accomplished.

"If the lenses composing the supplementary system are brought nearer together, as shown in fig. 2, it becomes a system of variable diverging focal length, transmitting divergent rays from any object to the lens, A, thus permitting a still more enlarged image to be received at F, any distance beyond the focal plane of the lens, A, depending upon the separation between B and C for the time being.

"If the lenses, B and C, are separated by any interval greater than the normal separation, as shown in fig. 3, it is obvious that it becomes a system of variable converging focal length. Parallel incident rays upon the supplementary system now emerge convergent, causing the image to be received upon a plane nearer to the lens, A, than its focal plane. In this case it will be seen that the linear magnification will be less than the ratio of the focal lengths of B and C, but the illumination may be greater than that of the lens, A, used alone. With the lenses separated as in fig. 3, it is evident that any near object may transmit parallel rays to the lens, A, with an enlarged image at its focal plane.

"It will be evident that near objects may be photographed with B and C, arranged as shown in fig. 2, but the plane of the image must be beyond the focal plane of the lens, A.

"The lenses, B and C, are each preferably aplanatic. The form ascribed to the lens, B, will determine that to be ascribed to C."

THE NEW SANDELL FILM.

THIS film dispenses with all extraneous support for the sensitised emulsion, and is a film wholly of gelatine emulsion suitably hardened to render it self-supporting, and to adapt it for use as a continuous film in the roll-holder or cinematograph.

The film, Mr. Sandell states, is produced by coating a suitable surface either with a single coating of emulsion of a thickness sufficient to afford the necessary tensile strength, or with two, three, or more superposed coatings of graduated degrees of sensitiveness, the coating (whether single or multiple) being afterwards stripped from the surface on which it is applied, and used without any adventitious support. The surface upon which the coating, or coatings, of emulsion is, or are, thus applied, is preferably that of a sheet or strip of glass, perfectly flat and highly polished; and, in order that the film may possess the hardness necessary to render it self-supporting, a hardening agent, such as an alum or formic aldehyde, is incorporated in sufficient quantity with the emulsion.

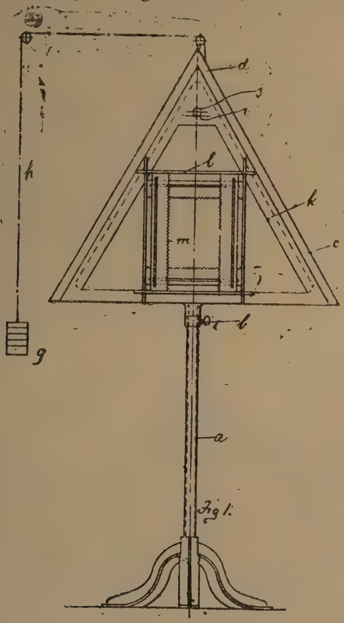
The proportion of the hardening agent will depend upon the initial state of hardness of the gelatine used in the composition of the emulsion, this hardness varying within somewhat wide limits in the case of different parcels of gelatine as supplied by manufacturers of that article. Generally speaking, however, about one and a half per cent. by weight of chrome alum relatively to the weight of gelatine used in the emulsion will suffice.

The use of a hardening agent is of importance as tending to facilitate the manufacture of the films by accelerating the setting and drying of the emulsion, whether the films be formed of one or of several superposed coatings, it being, of course, necessary, in the latter case, to allow one coating to become thoroughly dry before a further coating is applied.

HOLT'S METHOD OF PRODUCING VIGNETTES IN COPYING.

[Patent No. 5386 of 1899.]

"I place an angular or other shaped frame, *c*, of a convenient size for photographing the picture to be copied, and at the apex, *d*, of this frame I place a chain of wheels, *e*. Figs. 1 and 3, actuated either by a spring in a barrel (fig. 3), or by a weight, *g*, acting by means of a cord, *h*, on a wheel of any convenient size to react (by gearing) upon the chain of wheels, *e*, aforesaid. By either of the above means I cause the spindle, *i*, to revolve, and upon this spindle, and revolving with it, I place an eccentric, *j*, upon which hangs the screen, *k*, constructed of any light material, such as aluminium, wirework, mica, cardboard, or otherwise.



"The motion given by the eccentric, *j*, to the said screen, *k*, is an upward and downward, as well as a sidelong, motion, by which means a circular motion is produced towards the centre of the screen, where is fixed or hung the disc, *l*, carrying the serrated edges, *m*, which can be adjusted to any opening or position on the said disc by means of clips, set screws, or otherwise.

"I also regulate the speed of the said chain of wheels, *e*, by means of a brake or a fan, so that the rotary movement of the said disc, *l*, carrying the serrated edges, *m*, can be varied; and I also regulate the throw of the eccentric, *j*, by means of a slotted sliding bar, so that the travel of the said screen, *k*, carrying the disc, *l*, and serrated edges, *m*, may be varied."

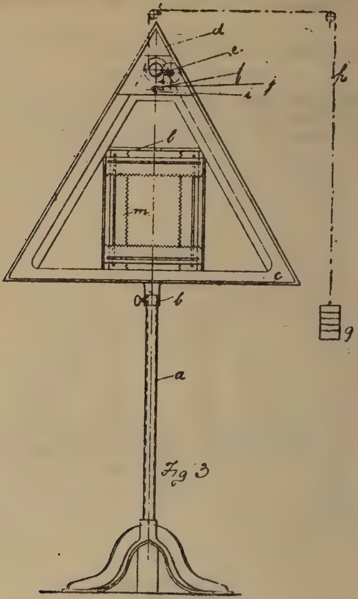


Fig 3

FLECK'S FOCUSSING DEVICE.

This consists of two parts or "focussing bags," *m* and *n*, connected together by means of concentric rings, k^1 and k^2, that are rotatably fitted together. The part, *m*, which has preferably the form of a bellows, is attached at its front end to the back of the camera. The part, n, is provided at its rear end with a mask, *q*, which is shaped to fit the face, and which is formed with sight holes directed towards the focussing plate mounted in the camera frame, *b*. These sight holes are preferably fitted with eyepieces, *o o*.

For the purpose of enabling the focussing to be effected with still greater sharpness, the part, *n*, is made of soft light-excluding fabric.

If it is desired to view more fully the outer portions or edges of the image on the focussing plate or screen, it is merely necessary to remove the eyepieces, *o o*, together with the mask, *q*, resting normally in a fork support (not shown in the figure) out of the said support, and to move the same around the entire contour of the image within the limits of the ring, k^2.

The forked support is mounted on the upright, *c*, in which also the outer ring, k^1 is fixed. The upright, *c*, can be made to slide for the purpose of adjustment in guides fixed to the camera frame, and, when the correct distance from the focussing plate has been found, the upright, c, is clamped in the said guides by means of a spring or pin.

Fig 1

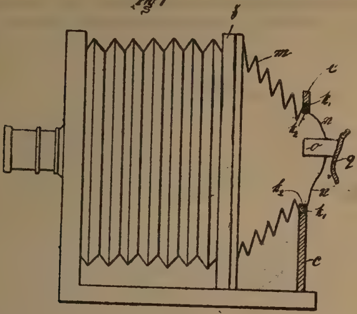


Fig 2

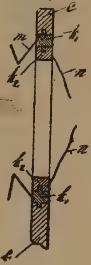
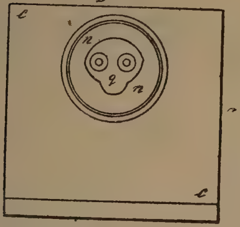


Fig 3



SCREENS FOR ORTHOCHROMATIC PHOTOGRAPHY.

Mr. R. W. Artlett employs two discs of glass (figs. 1 and 2), which preferably have plane surfaces, but which may ground to a slight curvature. Each of these is coated on one side with a film of gelatine, collodion, or other suitable material, and each film is then dyed, the one (fig. 1) a strong bright yellow, and the other (fig. 2) a clear strong red. The yellow-dyed film permits the red, yellow, and green rays to pass, and intercepts the whole, or nearly the whole, of the blue rays, whilst the red-dyed film operates to intercept the violet, indigo, blue, and green rays. In the centre of the yellow film there is a small circular vacant space, *d*, and in the centre of the red film there is a comparatively large circular vacant space, *b*. The two discs are now cemented together, film to film (fig. 3) with Canada balsam or other cement having a refractive power corresponding as nearly as may be with that of the gelatine or collodion film.

Mr. Artlett states that a coloured screen prepared in the manner above described transmits a small quantity of the very energetic blue and violet rays (along with the other rays constituting white light) through the central space left vacant in both films, a large quantity of the green rays (with red and yellow) through the yellow annular space which intervenes between the central clear space, a, and the red film, and a much larger quantity of the comparatively inactive orange and red rays through the outer or red-cum-yellow portion of the compound screen.

By adjusting the proportions between the central or clear portion, the outer or red-cum-yellow portion, and the intervening yellow portions of the screen, the quality of the light admitted may be regulated so as to obtain the most perfect results, and although it is desirable to have a small central vacant space in the yellow-dyed film, it may sometimes happen that the circumstances will admit of the use of the film intact.

Fig. 1

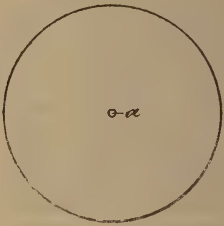


Fig. 2

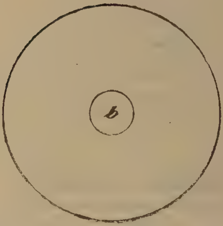
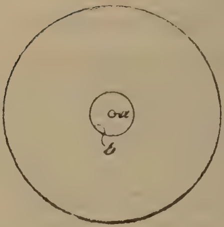


Fig. 3



The screen is placed in the lens in a position as near as may be to the diaphragm.

HARGREAVES' FERRO-PRUSSIATE PRINTING PROCESS ON PAPER, LINEN, COTTON, &c.

The designs are fixed upon any of the above-mentioned materials by the deposition or precipitation of a pigment, lake, or colouring matter heretofore unknown in photographic printing.

The pictures produced are unchanged by exposure to sunlight, are beautiful in colour, and will stand a boiling soap solution.

The process dispenses with the use of any of the salts of gold, platinum, silver, or other precious metals, and is a development or extension of the well-known ferro-prussiate process.

Two chemical substances, ferric ammonic citrate and potassic ferricyanide, are each separately dissolved in water, in about the following proportions:—140 to 175 grains ferric ammonic citrate in 3 ounces water; 120 to 150 grains potassic ferricyanide in 3 ounces water. The above solutions are then mixed.

The solution of these two materials is brushed over a piece, say, of bleached cotton cloth of any required size, or the pieces of cloth may be dipped into the solution, the operation being done in a dark place.

The excess of solution is now pressed out by means of, say, pressing rollers or any other suitable method, and in this condition the sheets are carefully dried in the dark.

The sensitised sheets are now used for printing in the usual way known to photographers and engineers from photographic negatives or drawings made on thin transparent paper or cloth. After printing, it is only necessary to wash out the unchanged or soluble material by means of water, whilst the changed portion which is blue, being insoluble, remains.

"It is important that the blue prints should be well washed in water in order to eliminate all unchanged chemicals; and, in order to do this more effectually, I may digest them in a dilute solution of hydrochloric acid, and afterwards well wash in pure water.

The essence of the invention consists in utilising the iron contained in the blue colouring matter as above produced by actinic light, and making it the medium or base for the formation of another colouring matter.

In other words, the inventor uses the iron in the blue as a mordant in the same way as calico-printers purposely fix oxide of iron on cotton cloth as a preliminary in the dyeing of purples, blacks, greys, &c.

When cotton cloth on which there has been fixed an oxide of iron is subjected to certain dyeing materials, such as alizarine or logwood, purples and blacks are produced, the first-named material producing a well-known and highly esteemed coloured lake known as madder or alizarine purple, and is one of the most permanent colouring matters known.

The chief novelty consists in utilising the fact that the blue colour referred to, being an iron compound, acts as if oxide of iron alone were fixed on the cloth, and it can therefore be used as a mordant, or, in other words, as a basis for the formation of purples and blacks.

The blue prints are subjected to the action of a dye bath containing any or all of the following dyeing materials added to a considerable volume of water: madder, alizarine, purpurine, or logwood.

The blue prints are preferably entered into the dye bath at a temperature of about 100° F., and the temperature gradually raised in thirty or forty minutes to the boiling, and agitated during the whole time. They are then well washed in clean water, and afterwards treated to a boiling soap solution. They are then well washed, dried, pressed, and (if desired) starched, and mounted in any desired manner."

THE HOFMANN FILM.

THIS process of film photography is due to Mr. Albert Hofmann, of Cologne.

Smooth, well-gummed, even baryta-weighted or similarly prepared papers, or woven materials, or other flexible bodies serving the purpose, are coated either on one side or both sides with substances soluble in alcohols, ethers, or benzines, such as resin alone or in combination, but at all events not made brittle, but softened through being dissolved in fatty oils or turpentines. The best results are obtained with simple solutions of shellac, gum sandrac, or mastic, with the addition of fatty or drying oils, *e.g.*, castor oil, also with turpentine or the common pine-tree resin, with suitable additions to make and to maintain the product soft and ductile.

Just as good are the soluble albuminous bodies of cereal origin, such as vegetable gluten.

After this film is taken up and is dried on, one applies a gelatine coating, to which is added a hardening medium, alum, chrome alum, or the like. With a suitable concentration, one can get a sufficiently thick coating in one operation, otherwise one must repeat the operation often enough to give the final product the requisite strength, in order that it may act as independent negative without any later strengthening. Under certain conditions, gelatine can be applied to both sides of the paper, and, after being dried, coated with a layer sensible to light, whereby it is rendered serviceable for using on both sides. In this case the original paper must be blackened. The laying on of the sensitive sheet is accomplished in the well-known manner, as well as the development, fixing, and washing of the negative after exposure.

Before the negative is dried, it is placed for a few minutes in a spirit bath, after which the paper easily loosens itself from the foundation. In order that the separated negative may be hardened and softened, it is now immersed in alcohol containing five per cent. of glycerine and five per cent. of formalin.

The film coming out of this alcoholic glycerine bath is then dried, suitably pressed on to a scrupulously clean glass plate, varnished, and copied, exactly like every other negative.

It can, however, be used as an independent film, without transfer to a glass plate.

A SILVER PHOSPHATE PRINTING PROCESS.

DR. JOHANNES MEYER, of New York, the patentee of this process, directs that to an aqueous solution of one drachm of silver nitrate a well-diluted solution of solium phosphate is added. The resulting silver phosphate is well washed, by decantation, and brought to the volume by one fluid ounce. To this silver phosphate held in suspension we add five drachms of tartaric acid dissolved in five drachms of water, at the same time imparting to the containing vessel a quick rotary motion. In this way is obtained a white jelly-like mass of a volume of two ounces, containing a quantity of silver phosphate equivalent to the drachm of nitrate we started from. It is essential that all the chemicals, including the water, be chemically pure.

To render this emulsion more fluid, it is either slightly heated, or agitated with a glass rod, or by shaking the bottle. In this state it is used for coating the paper or other surfaces on which it is desired to print.

The proportions given above are the best for practical use. The preparation of the emulsion is, however, easier, for one not experienced in this special line of work, by mixing a fluid ounce of silver phosphate with a smaller quantity of tartaric acid; for instance, two drachms of acid in two drachms of water, when the emulsion will set more readily. When the emulsion is left in its jelly-like state, crystallisation will set in, after some time, while a portion of the silver is retained in the solution.

Citric acid seems to have the greatest affinity for silver phosphate. Twelve drachms of citric acid mixed with one fluid ounce of silver phosphate will produce a clear transparent solution which has remarkable sensitiveness and qualities.

The emulsion, or solution of silver phosphate in organic acid, thus obtained is then applied in any suitable manner to the surface to be sensitised. It may be applied by means of a soft, flat camel's-hair brush to paper, after which it is permitted to dry. When this sensitised photographic paper is exposed under a negative to direct or shaded sunlight, a positive picture of great accuracy and agreeable tone is obtained. When the paper is first coated with albumen or gelatine, or any similar substance, a photographic print can be produced in less time than by the silver haloids heretofore employed, and not only sunlight, but also artificial light, can be used for producing a direct print. The photographic print thus obtained can be toned by any of the well-known toning solutions, and finally fixed by means of sodium hyposulphite. The print is then washed until no trace of the hyposulphite is left in the same. In place of paper, any other material, such as wood, celluloid, lithographic stone, silk, cotton, or other textile fabric, and other materials, can be coated with the photographic film, and pictures of great delicacy and beauty, not inferior to prints on paper, be produced thereon.

The advantages of the improved process of producing photographic films are that silver phosphates can be employed without the aid of a viscous substance like albumen or gelatine; that the silver phosphate emulsion, or solution, can be spread over almost any surface, like a paint or dye; and that only a very weak solution of sodium hyposulphite, and a short immersion of the prints, is required to remove the unchanged silver and render the prints permanent.

When the prints are left in the fixing bath for a longer time than a minute, the sulphuration of the prints will commence, which is induced by the organic acid, and which will be completed to blackness of the picture in a few minutes more. Though sulphur toning is believed to have many objectionable features, the prints made by the process described do not suffer in appearance if the sulphuration is not too long continued. The use of albumen will prevent the prints which have been toned by sulphur from becoming yellow and faded by atmospheric oxidation. These results were obtained by a number of tests, continued through a considerable period of time. The dominant colour of the prints made by the silver phosphate emulsion or solution is a brown or auburn shade, which darkens considerably with the drying of the prints. Toning may therefore be dispensed with in many applications in the arts. When the prints are made on textile fabrics they are generally brown in tone, but this can be changed, in the case of cotton, to black, by passing a hot flat iron over the same, while prints on silk will not undergo this change. Though the predominating colour of the silver phosphate prints is brown, many of them show various other tones, and it must be assumed that certain negatives act as a medium for the transferring of colour qualities and influence the production of the tone to a certain degree under conditions not yet known. When a silver bromide emulsion is added to a silver phosphate emulsion, the sensitiveness of the solution is so increased that even the light of a common petroleum lamp is sufficient to produce a direct print. The sensitiveness of the emulsion is also increased by the addition of a small quantity of citric acid. The solution of silver phosphate in citric acid, when applied to a plain piece of paper and exposed under the negative to direct sunlight, produces a print of very agreeable bluish tone, which will compare favourably with other prints in accuracy, in the high lights, and in the depths of the shadows.

Paper coated with albumen and sensitised with a silver phosphate emulsion or solution has great durability, and will not deteriorate under climatic influences. It can be used therefore at any time for printing, without impairing the quality of the print. . . . . The print is removed from the printing frame directly to the fixing bath, to which sodium bicarbonate is added when the original colour of the print is to be preserved. The print remains in the fixing bath for a short time, and is then freed from any adhering traces of sodium hyposulphite by washing it in hot or cold water for about five minutes.

A NOVEL TRIPOD HEAD AND STAND.

Mr. G. W. Atkins, of the Palmers Villa, Elstree, is an esteemed worker of many years' standing, to whose accomplishments in the mechanical

Fig: 1

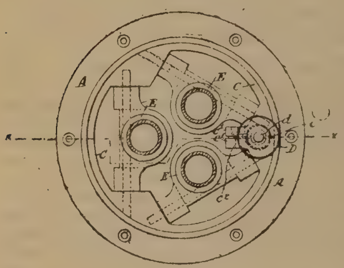


Fig: 3

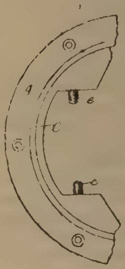


Fig: 4

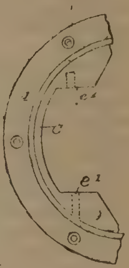


Fig. 2.

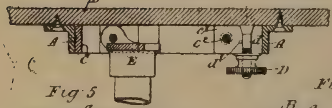


Fig 5

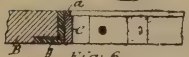


Fig: 7

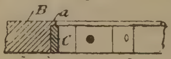
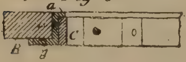
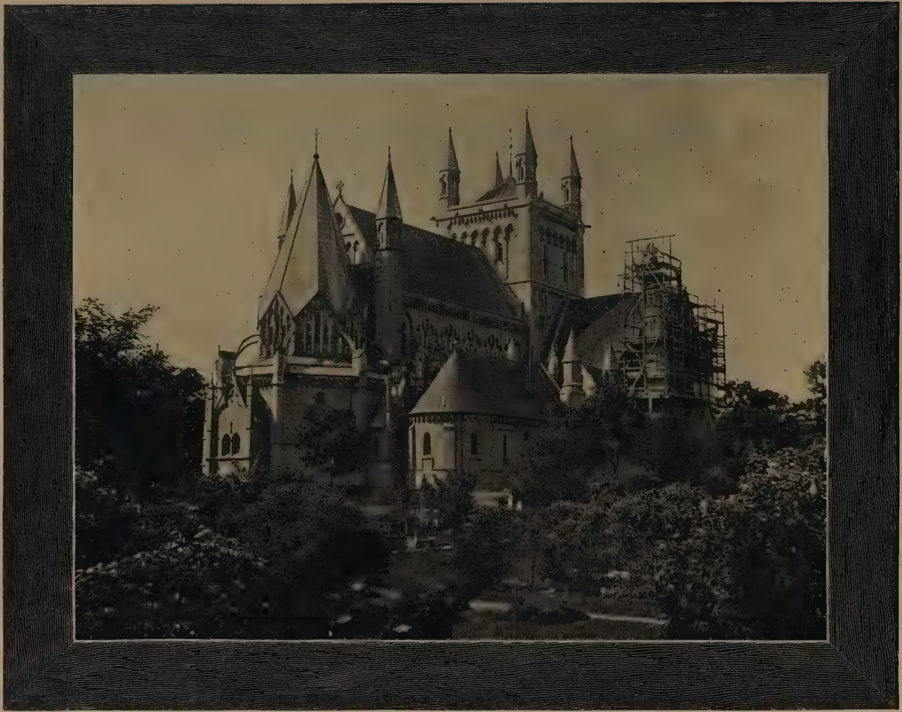


Fig 6



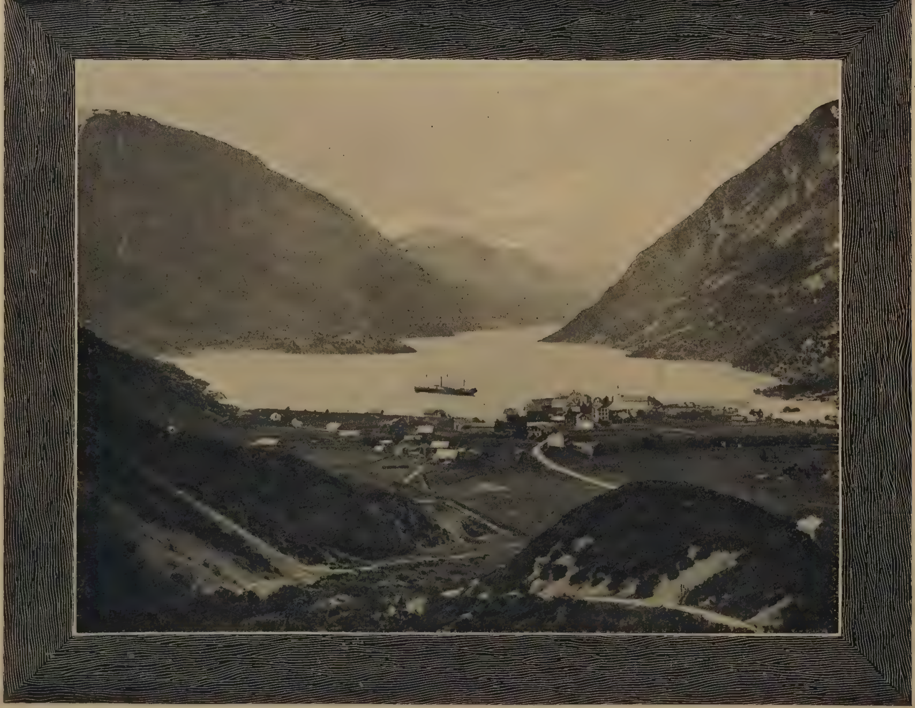
branches of photography our pages in former times often bore witness. He will be remembered by many of our readers as a valued member of the London and Provincial Photographic Association, of which he was long an officer. Endowed with many abilities out of the common, Mr. Atkins is alike highly skilful in making his own cameras, shutters,



TRONDJHEM CATHEDRAL.

From Photograph taken with the new (No. 8) Folding FRENA (Beck-Steinheil Lens).

Engraved and Printed by the Swan Electric Engraving Company.



ODDE.

From Photograph taken with the new (No. 8) Folding FRENA (Beck-Steinheil Lens.)
Engraved and printed by the Swan Electric Engraving Company.

brasswork, and even his own lenses. One of the best types of amateur workers, he has long been a devotee of stereoscopic photography. For some years resident in the country, he has now returned to take up his residence near London.

The latest outcome of Mr. Atkins's ingenuity takes the form of an ingenious method of attaching the camera to the stand. Quoting from the words of his patent specification, the bottom of the camera is furnished underneath with a metallic ring, permanently secured. Into this ring is inserted another ring, to which are secured the legs of the tripod. This ring is divided transversely, so as to be capable of expansion or contraction within the other ring, to make a firm bind therein or to permit of easy removal.

To proceed with the description: A is a metal ring, permanently secured to the camera base, B. When a ring is used, it may be secured by means of screws, as shown in fig. 2, or by letting the ring into the base, as shown in figs. 5 and 6.

In the cases of figs. 5 and 6, where the camera base is cut away to receive the ring, an internal flange, *a*, at the upper edge of the ring, is provided, and in fig. 7, where there is no ring, but merely a recess, a flange, *a*, is formed out of the material of the camera base.

C is also a metal ring divided transversely at *c*, and provided at that point with an expanding device; for instance, a conically ended screw, *d*, inserted between the lugs, c^1, c^1, and furnished with a thumb nut, D, for operating the cone or wedge to and fro, to expand the ring to the extent of its capacity, or allow it to contract. Its capacity for expansion is limited by a screw, c^2, passed through the lugs, c^1, c^1 (see fig. 1). d^1 is a small pin inserted in the screw, *d*, to prevent its rotation when the thumb nut, D, is turned.

The ring, C, being inserted into the ring or recess, A, so that it bears up against the camera base, or against the flange, *a*, the thumb nut is operated to expand the said ring, C, as above explained, to bind tightly with the ring or recess, A, attached to the camera, and in this way a quick and rigid attachment is effected.

To remove the support the thumb nut is unscrewed, thereby releasing the wedge and allowing the ring, C, to contract, when the apparatus can be readily taken apart.

Mr. Atkins has shown us one of the new tripod heads. These are made, at present, of aluminium. In use, the head is placed in the ring in the base of the camera, instantly "expanded" by means of the screw adjustment, and so firmly fixed that there is absolutely no fear of the camera becoming detached. It is one of the simplest and most effective means of attaching the camera to the tripod that we have seen, and, if placed on the market, will, no doubt, be highly popular.

HARRISON'S PRINT-WASHER.

An ordinary metal body or barrel, A, is mounted on a suitable stand, B. The feed water inlet consists (see figs. 1 and 2) of a series of holes or perforations, C, which extend along the bottom of the barrel, A, from end to end, and are inclined so as to produce a rotary movement of the water within the barrel.

The waste-water outlet consists of a parallel series of holes or perforations, D, which are preferably slightly larger than the inlet holes, C. The two series of holes run closely parallel, the inlet holes, C, and the outlet holes, D, being preferably arranged at alternate intervals (see fig. 2), so that the rush of water from each inlet hole passes between the adjacent pair of outlet holes, so dislodging any print having a tendency to settle over the outlet holes, D. By this means the outlet holes, D, cannot become choked by the prints as they are carried round the washer.

Separate inlet and outlet conduits, E and F, in connection with the inlet holes, C, and outlet holes, D, run longitudinally beneath the barrel,

FIG. 1.

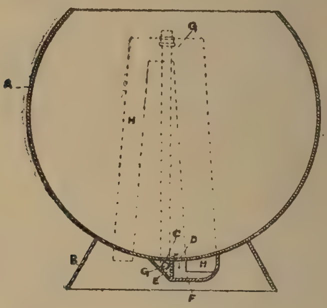
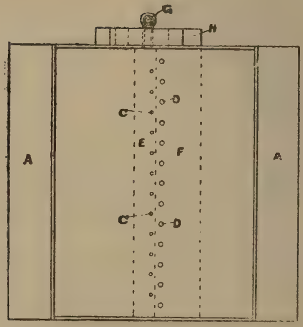


FIG. 2



A, the inlet pipe, G, being preferably carried from the top of the washer, and the outlet being siphoned over at H, so as to discharge at the bottom and so prevent splashing.

In place of the inlet holes, C, a fan feeder, K (see figs. 3 and 4), with a semicircular opening to the inside of the barrel, A, may be employed. In this case the pipe, G, and inlet conduit, E, are dispensed with.

As the interior of the washer forms an unbroken curved surface with

FIG 3.

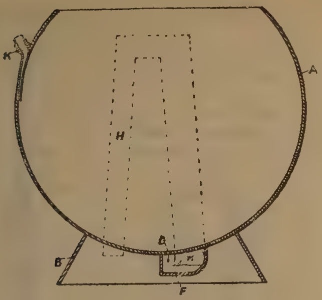
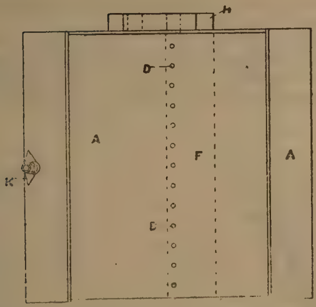


FIG. 4.



no projecting parts, the prints or plates are therefore not liable to damage during the washing operation.

TOMBSTONE PORTRAITURE.

The frame may form part of the tombstone, cross, wreath, or shade, or may be a separate part fitted thereto, or carried by a standard or standards, or other independent support.

The body, *a*, of the frame shown in figs. 1 and 2 is made of porcelain, or earthenware, or of any suitable metal or material. Near the top is a scroll, *b*, on which any suitable epitaph, text, or motto, or heading, can be moulded, printed, or otherwise produced.

In the middle of the body an opening, *c*, is formed to display the photograph or portrait of the deceased person, with or without an inscription, such photograph or portrait being held in a white metal or other frame, *d*, covered by a sheet of glass, *e*, and fastened to the body, *a*, by studs, *f*, or other suitable fastenings or equivalent devices; or instead of having an opening in the porcelain body, and attaching a metal frame to the back, the opening may be dispensed with, and the metal frame attached directly to the front.

FIG. 1.

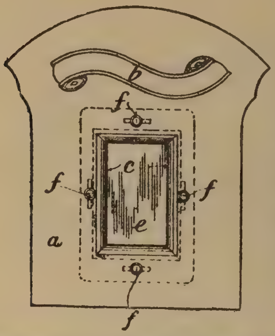
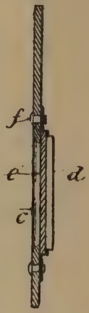


FIG. 2.



The frame may either be let into a recess formed to receive it in a tombstone or the like, or simply attached on the surface with screws or other fastenings, or it may be used alone as a headstone, or may be carried by an independent support like the wire-holder, *g*, shown in figs. 3 and 4.

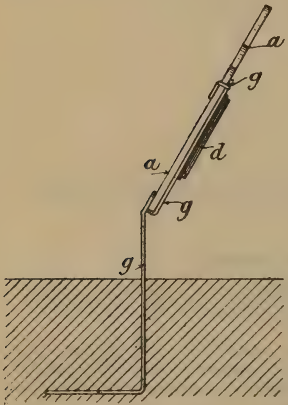


FIG. 3.

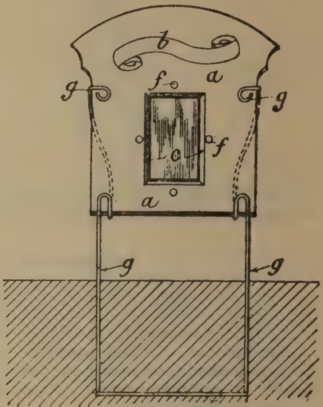


FIG. 4.

PHOTO-MECHANICAL PRINTING SURFACES.

[Patent No. 8088 of 1900.]

An impression on a translucent medium, such as paper, gelatine, celluloid, or the like, is first made from a printing block (woodcut, line etching, autotype, or the like).

The positive thus obtained is copied by means of light upon a plate of copper, brass, zinc, or other suitable metal, or on to stone, and developed in the same way as is usually employed for relief or cameo etchings, and in this process the same substances, sensitive to light, such as asphalt, chrome albumen, chrome gum, chrome gelatine, or chrome glue, or even mixtures of these separate substances, are employed.

A negative copy is thus obtained, that is to say, the metal or stone is blank at those places which correspond with the black parts of the positive, whilst it is covered at the places which correspond with the transparent parts of the positive, owing to the layer of asphalt, chrome albumen, chrome gum, chrome gelatine, chrome glue, or the like, rendered insoluble at these places by the action of the light, and therefore permanently retained when developed.

Instead of copying the positive directly on metal or stone, it may be copied on photo-lithographic transfer or pigment paper, and then the copy transferred in the usual way to metal or stone, and subsequently developed.

If the metal plate or stone be placed in an etching substance, that is to say, a solution which dissolves the metal employed, such as an acid, perchloride of iron, or the like, this solution can only attack the metal or stone at the uncovered places, as at the other places the etching liquid is kept off by the coating which covers the metal or stone.

A relief is thus obtained in which, as opposed to an ordinary printing block, the parts corresponding to the dark parts of the positive are countersunk or in intaglio, whilst the parts corresponding to the white portions of the positive are raised or in relief.

The relief is deeper the longer the etching substance is allowed to act on the plate. From the deeply impressed plate thus obtained impressions or prints may then be taken, which are applicable for use in a printing press. For instance, as in the case of the Woodbury prints, impressions may be taken therefrom, melted gelatine being poured over the plate, and then a sheet of paper or other flexible medium laid over it, and the whole placed in a press. After the gelatine has set, the sheet of paper may be drawn off the plate and dried. Celluloid, papier mache, indiarubber, guttapercha, or other suitable material, may be employed in place of gelatine for forming the relief, whilst the penetration of the material into the etched (intaglio) parts of the printing plate may be assisted, if necessary, by the application of heat.

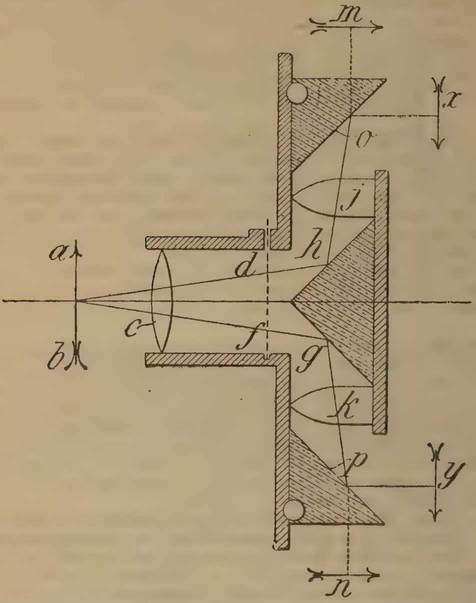
SZCZEPANIK'S IMPROVEMENT IN OPTICAL PROJECTION APPARATUS.

[Patent No. 17,514 of 1899.]

The patentee says that it is known that each portion of the opening in the diaphragm of an objective is sufficient to project an image. Hence, in order to project simultaneously two, three, or even more images, the pencil of rays passing through the diaphragm is divided into two, three, or more portions by means of mirrors. Consequently each portion forms an image which can be reflected by means of mirrors upon any desired surfaces.

a b is the object, which, in the case represented, is to be projected in duplicate. *c* is a lens or system of lenses. *d*, *f* is the diaphragm opening. *g*, *h* are two plane mirrors, the edges of which divide the pencil of rays passing through the diaphragm into two parts. *j*, *k* represent two lenses or systems of lenses.

It is obvious that the two lenses, *j* and *k*, yield exactly similar and



sharp images, which appear on the surfaces, *m* and *n*. If, however, one wishes to direct the said images upon one and the same surface, two mirrors, *o* and *p*, must be used in addition, which are parallel to the mirrors, *g* and *h*. By this means two images, *x* and *y*, are reflected upon one surface.

For different sizes the lenses, *j* and *k*, must be moved away by means of toothed wheels and racks, or of worms and worm wheels. If transparencies (*i.e.*, translucent positives) are secured in the places of the images, *x* and *y*, and illuminated by means of condensers, one obtains from the two transparencies a common sharp image.

In a similar way, an apparatus for three images can be constructed.

By means of such an instrument it is possible to produce naturally coloured images. This is done in the following manner:—Three colour filters, for blue, yellow, and red respectively, are inserted; one before each projected image, and either in front of the surface on which the images are projected, or just behind the diaphragm orifice, *d f*. If, from the negatives obtained, one produces three transparencies, all the three images resulting from these three negatives, when placed in the position of the negatives from which they will have been produced, will, if three colour plates be used, be differently coloured, and will jointly yield, as is known, an image in natural colours. Since only a portion of the diaphragm is used, the luminous intensity of each individual image is small. In spite of this it is possible to project very luminous images by using a special source of light for each transparency. In this way one has at disposal three sources of light instead of one.

Since the exposures for different colours are different, the pencil of rays proceeding through the diaphragm opening must be divided by the mirrors in such a manner that the effects of the exposures for all the openings are equal in the same time for all three colours.

To take the photograph for each colour separately, the corresponding colour filter may be inserted in front of the objective, and the two other images that are not to be photographed be prevented from appearing by suitable diaphragms.

GARCHEY'S IMPROVEMENTS IN COLOUR PHOTOGRAPHY.

[Patent No. 19,843 of 1899.]

All photographic processes by powdering, says the patentee, hitherto described are based upon bichromate solutions as devised by Poitevin. The chief objection to these solutions is the fragility of the film, which on washing in most cases disappears or is damaged, thus destroying the photograph.

"One object of my invention is to strengthen this film by incorporating a reinforcing substance with the emulsion. Collodion presented itself, but there was great difficulty in mixing it with the sensitive emulsion. All these solutions contain much water, and if collodion were introduced it would be decomposed, forming a precipitate of cotton. In order to avoid this difficulty I have devised the following process:—

1. I first dissolve the bichromate in the least possible quantity of water, or I employ a saturated aqueous solution.
2. With this I incorporate sirupy matter, such as honey, glucose, or dextrin.
3. I add alcohol and a small quantity of anti-photogenic colouring matter.
4. And, lastly, I introduce collodion, which melts in the mixture without decomposing, or, instead of collodion, I introduce ether and then cotton to dissolve in it and form the collodion in the mixture.

The anti-photogenic colouring matter introduced is intended to prevent the soft effects of the interference of luminous rays which sometimes present themselves on proofs on glass, opal, or the like.

The emulsion prepared as above described is employed to sensitise plates; and these, after the image is developed, can be repeatedly subjected to acidulated washings without injury, and thus very large plates may be employed, such as could not be used when methods hitherto known are used.

For applications of photography in colour or in producing impressions in various tints I have found it necessary to isolate the photographed and developed film between two successive positives.

Thus before each new print I cover the film which has already on it a first colour impression with a layer of a weak, about two per cent., solution of organic material, such as gum or gelatine. I can then apply emulsions to the negative as often as I desire, the isolating layer preventing the new emulsion from dissolving the previous ones.

For producing enamels I prefer to use plates of glass, porcelain, metal, or other material that can be baked, and for developing the pictures I employ coloured powders of vitrifiable enamels.

For producing prints on paper, paste-board, celluloid, or the like, which are not intended to be baked, I operate in the same way, provided that the negatives are in the first place made impermeable, and I develop the pictures with coloured vegetable or mineral powders.

If, for instance, Ducos du Hauron's method of photographing with the three fundamental colours is employed, I operate as follows:—

After having printed and developed, by yellow powder for instance, and washed with acidulated water, the bichromate film, strengthened with collodion which has been exposed to the plate forming the yellow screen, before being treated for the other tint colours, has spread over it a layer of isolating matter and is dried. Then a fresh emulsion can be applied, and the film can be exposed to the screen for blue and developed and powdered with blue. After washing with acidulated water the like operations are repeated for the red. Many other tints might be applied if necessary.

As I have stated, my process allows of very large films being employed, but, in order to avoid the use of very large screen plates, I print by projection and direct enlargement, and thus I can decorate large surfaces with photographs in colours.

The application of pictures in black or in colour to large glass plates is objectionable because, if the pictures are transparently looked at, the half tints become thin and have only their value when the surfaces are covered with a layer of translucent enamel.

I remedy this by first applying over the whole surface white or dull enamel powder, thus having a translucent ground for the desired colour. On this ground I put a layer of the isolating material, sensitise afresh, and develop as many times as desired, as above described. On baking, the ground becomes indelible and the desired effect is obtained."

THORNTON'S MACHINE FOR COATING SENSITIVE FILMS, PAPERS, &c.

[Patent No. 5793 of 1899.]

For coating a sensitive emulsion upon a support of thin, flexible material, A, such as paper, celluloid, or other web material, a machine is constructed with a roller, B, to apply the emulsion to the film, A, a jacketed or heated trough, C, a ductor roller, D, rotating in the trough to convey the emulsion to the coating roller, B, and enclosed chamber, E, through which the web support, when coated, passes air ducts, F, through which heated air is forced and caused to impinge upon the travelling web support, A, and guide rollers, G, placed to conduct the material over the coating roller and through the drying chamber, E.

A straight drying chamber, E, as shown in fig. 1, or a curved or cylindrical drying chamber, E^1, as shown in fig. 2, may be employed.

For the coating of a stiff or rigid support, H, such as plates of glass, celluloid, mica, or the like, the machine is constructed with a travelling carrying band, K, passing over guide rollers, L, and provided with a number of traverse ribs, *k*, by which the plates, H, are held in position thereon. Above or in close proximity to the travelling carrier band, K, is placed the trough or box, M, for containing the emulsion, and over the travelling carrier band, K, is formed the drying chamber, N, with the air ducts, O, through which the heated air is forced upon the coated plates as they are carried through.

In the emulsion box or trough, M, is placed a revolving silver gauze cylinder, P, which rotates in the emulsion, and inside the gauze cylinder is placed a flat air tube or nozzle, R, the width of the plates, through which a blast of air is forced. In the side of the trough or box, M, opposite the air tube, a slit is formed, through which the emulsion adhering to the silver gauze of the cylinder, P, is blown in a fine spray on to the plates, H, carried by the travelling carrier band, K.

An exceedingly fine layer or coating of the emulsion is deposited on the support, A or H, and dried as such passes through the machine, and

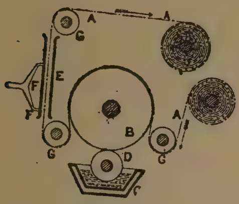


FIG. 1.

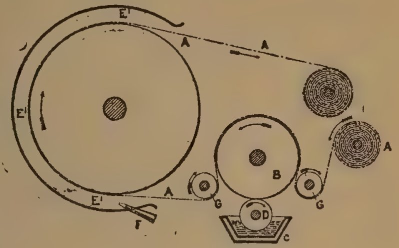


FIG. 2.

the process is repeated and again until the finished coating of the sensitive emulsion is the desired thickness. It will be necessary in this manner to apply about from ten to twenty coats to obtain a thickness equal to that usually applied at the one operation.

The paper or flexible film support may be reeled as shown after each coat, and passed repeatedly through the apparatus or a number of coating rollers, and drying chambers or cylinders may be arranged in one machine (see fig. 4), so that the support may be fully coated with the requisite number of fine coats at one operation.

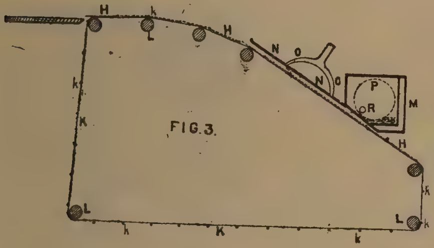


FIG. 3.

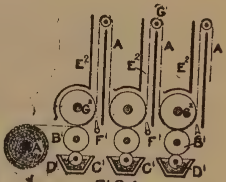


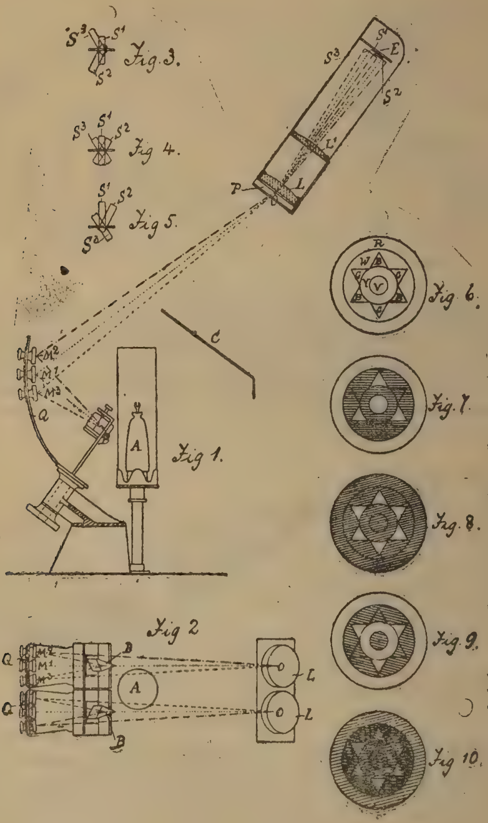
FIG. 4.

In fig. 4 the apparatus is made up of any number of sections, comprising a coating roller, B^1, trough, C^1, ductor roller, D^1, to apply the emulsion to the coating-roller drying chamber, E^2, into which the heated blast of air is injected by the nozzle on the perforated pipe, F^1, and guide rollers, G^1 and G^2, the roller, G^2, may be heated if desired. Likewise a number of spraying apparatus may be used.

THORPE'S METHOD OF COLOUR PHOTOGRAPHY.

[Patent No. 11,466 of 1899.]

A GLASS, or other suitable transparent plate, is coated with a sensitive film of bichromate gelatine, which is kept in a somewhat soft state until exposed to light by the addition of a small percentage of some suitable substances, such as glycerine. On this film is mounted a celluloid or other suitable replica of a diffraction grating, of preferably from 10,000 to 40,000 lines to the inch, the ruled side being in contact with, and,



preferably, impressed into the gelatine film, so as to produce the grating lines on the film by mechanical action.

One of the original isochromatic transpanencies being now laid over the plate prepared as aforesaid and exposed to sunlight or other suitable source of light, the portions of the gelatine film under the clear parts of the transparency will be rendered more insoluble in water than those parts which are under the opaque portions of the transparency. The celluloid or other grating being now detached or dissolved by a solvent having little or no effect upon the gelatine, such as acetone, and the plate washed in water, the reproduction of the grating is found upon the gelatine, varying in the intensity of its diffractive action according to the proportion of light each part has received through the transparency.

In making these diffraction transparencies from the different original isochromatic transparencies, the lines of the grating are placed in each of them at a different angle to the picture, so that each transparency is lined in a different direction from the others, all the gratings, however, having the same spacing, which preferably is as fine as possible.

Fig. 6 represents a coloured plaque or design to be photographed and rendered visible in colours, R denoting red, W white, G green, B blue, Y yellow, and V violet. Of this plate three negatives are taken through green, red and blue screens, and positives printed on glass or other transparent plates in the ordinary way. It is obvious that in these positives only those parts of the plaque will be quite clear that contain the pure colour corresponding with that of the respective screen, and more or less clear in the parts of a colour into the composition of which the colour of the screen enters, and be opaque on those parts the colour of which does not contain the colour of the screen. Thus, in the transparency taken through the green screen, the parts marked G on fig. 6 will be clear, and those marked W and Y more or less so, while the rest will be opaque. When this transparency is placed upon the plate coated with a sensitive film of bichromated gelatine, into which a replica of a diffraction grating has been impressed, and exposed to light, as described above, the parts marked G, W, and Y, on fig. 6, will transmit light, and the bichromated film be rendered more or less insoluble, while under the other parts it will remain soluble, and, after being washed, a lined transparency, as shown by fig. 7, will be obtained, the grating lines on this transparency being placed, say, horizontally, as indicated.

In the same way the diffraction transparency obtained from the transparencies taken through the red screen will be as represented by fig. 8, the celluloid replica of the diffractive grating being in this case impressed upon the bichromated film at an angle to the horizontal as shown, the angle of the lines being preferably ten degress or less, but shown exaggerated on the drawing for the sake of clearness.

The diffraction transparency obtained from the transparency taken through the blue screen will be represented by fig. 9, the diffraction grating being in this case impressed upon it at any angle inclined to the horizontal in the opposite direction to that used for the transparency (fig. 8).

If more than three transparencies, obtained through other coloured screens, are used, the lines on the diffraction transparencies made from them are preferably placed at intermediate angles corresponding to the position of the respective colour in the spectrum.

The three diffraction transparencies (figs. 6, 7, and 8), hereinafter called the green, red, and blue plate respectively, are now, preferably, permanently superposed with the picture or image coinciding, as shown on fig. 10, and when viewed or projected in a suitable manner, either by reflection or transmission, are seen in colours; and, where the isochromatic photographs are taken from natural objects, with the natural differences of light and shade.

For the purpose of viewing, preferably the first order of spectra from transmitted light is used and brought to a focus at the eye by means of a lens placed immediately above the transparency, and when the picture is in good definition as seen by an eye lens, such as is used in the stereoscope, each transparency being illuminated only by direct or reflected light in a plane perpendicular to the direction of the lines upon it, while the actual light is screened from the eye, the picture on each transparency is seen uniformly coloured according to the portion of the spectrum yielded by the grating, and, when the lights or mirrors reflecting the light are moved into such positions that the diffracted pencils from each transparency transmitted to the eye are of the same colour as the screens through which the original photographs were taken, the picture appears in its natural colours.

By figs. 1 and 2 an apparatus suitable for viewing is represented diagrammatically in elevation and plan.

In this apparatus the points of illumination, lenses, and images on the transparencies are duplicated so as to obtain the respective spectra and images at two eyeslits, for the purpose of showing the photographed object stereoscopically.

On the drawing, A represents a Welsbach incandescent burner from which the light falls through slits upon two totally reflecting prisms, B, which reflect the rays of light to the reflectors, M. Instead of the burner, A, and prisms, B, in some cases two incandescent filaments in the position of the prisms may be used with advantage. The light from the mirrors falls upon the combined diffraction transparencies, P, and passes through the lens, L, and the picture is viewed through the stereoscopic lenses, L^1, and narrow eyeslits, E. C is a screen to shield the transparencies from the light of the burner.

For the purpose of causing the rays of light to fall on the respective diffraction transparencies lined with gratings of uniform space but different inclinations to the picture, in a plane perpendicular to the inclination of the lines, and to vary the angle of incidence, the reflectors, M, are attached to the surface, Q, of an ellipsoid of revolution, the major axis of which is in the line of the reflecting point of the respective prism, B, and the centre of the lens, L, which are in the foci of the ellipse, the rotation of which round the axis forms the ellipsoid. It is evident that the light rays from the prism will be reflected to the centre of the lens in any position of the reflectors, M. Slots radiating from the axis are formed in the surfaces, Q, so as to vary the position of the mirrors, M, and the angle of incidence. The inclination of these slots to the vertical is the same as the inclination of the grating lines to the horizontal, so that the rays, B, M^1, O, are in a vertical plane perpendicular to the lines on the green plate, the rays, B, M^2, O, in a plane perpendicular to the lines on the red plate, and the rays, B, M^3. O, perpendicular to the lines on the blue plate. The three gratings diffract the rays transmitted by the mirrors into spectra in the same planes as the rays, and, if the respective angle of incidence is so arranged by shifting the mirrors that the green part of the spectrum, S^1 (fig. 3), formed by the green plate, the red part of the spectrum, S^2, formed by the red plate, and the blue part of the spectrum, S^3, formed by the blue plate, fall upon the eyeslit, the photographed object will be seen in its natural colours, the eyes being preferably placed at a short distance from the eyeslits.

If the position of the mirrors is changed, the colour received into the eye from the different plates will be changed. By placing the mirrors, M^2 and M^3, into the line of mirror, M^1 for instance, the green part of the three spectra will be transmitted through the slit, as represented by fig. 4, and the object will appear all green; by shifting the three mirrors to the top it will be shown all red, and by shifting the three mirrors to the bottom it will appear all blue. By shifting the mirrors, M^1 and H^2, to the bottom and the mirror M^3 to the top, the blue parts of the spectra from the green and red plate, and the green part of the spectrum from the blue plate, will fall into the eye, as represented by fig. 5, so that the green and red portion of the photographed object will appear blue, and the blue parts green. It will be evident that by altering the positions of the mirrors any part of each spectrum can be made to fall into the eye, and any variety of different colourings besides the natural colours rendered visible.

In some cases the mirrors, M, may be replaced by incandescent filaments movable in the same way, and the prisms and burner, or other source of light, omitted.

In the case of flat objects, such as designs of wall papers, for instance, or where a stereoscopic effect is not to be produced, of course only one set of reflectors and one source of light and diffraction transparent photographs are required.

In the case of designs in two colours, of course only two diffraction transparencies and two reflectors will be wanted. The diffraction transparencies for such designs, and the like, can be produced without the aid of photography, by placing a celluloid replica of a diffraction grating over the design, or drawing it upon such replica, and painting for each colour the parts having a different colour with varnish to fill up the grating spaces, placing the grating lines at a different angle for each colour. Thus the three plates (figs. 7, 8, and 9) can be obtained by placing three celluloid gratings over the design (fig. 6), at the respective angles, and painting the white parts in figs. 7, 8, and 9 with transparent varnish, which, when superposed and inserted into the apparatus, will show the design in its original or any other colours, in the same way as the gelatine diffraction transparencies obtained from photographs taken through isochromatic screens in the manner hereinbefore described. The transparencies may likewise be produced by printing on the celluloid gratings with varnish or like filling, and making transparent replicas of them in the manner hereinafter described.

SZCZEPANIK'S SYSTEM OF PRODUCING MULTIPLE PHOTOGRAPHS.

[Patent No. 7431 of 1899.]

An opaque plate, *d*, possessing suitably distributed holes (see fig. 2), is

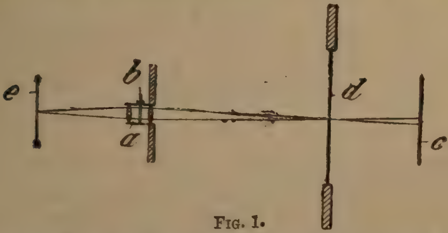


Fig. 1.

arranged between the objective and the image-receiving screen, consisting, by way of example, of a matt or ground-glass disc, *c*.

The figure or object of which a multiple representation is to be made may be formed by the diaphragm opening itself, or a transparent negative or diapositive of the object may be arranged in place of the diaphragm. On illuminating, an image of the object appears on the matt or ground-glass disc for every hole in the plate; thus there are formed just as many copies of the object as there are holes in the plate, *d*.

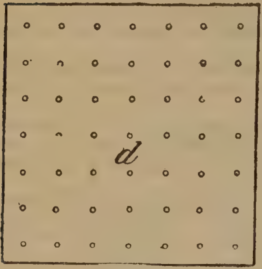


FIG. 2.

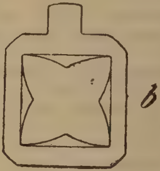


FIG. 3.

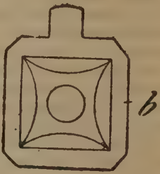


FIG. 4.

If the openings in the plate, *d*, are near enough together, the diaphragm images combine to form a pattern, design, or ornament, as is shown in fig. 5.

The negatives or diapositives to be placed in the objective instead of the diaphragm may consist of paintings on glass plates. If a sensitive photographic plate be used instead of the matt or ground-glass disc, then from one object, and by a single impression, as many photographs

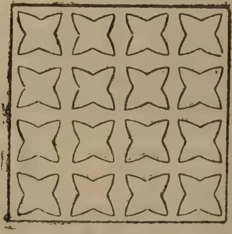


FIG. 5.

of the object can be obtained as there are holes in the plate, or a repeat design or ornament (fig. 5) can be produced.

It is possible to produce, by the method described, photographs that can serve different purposes, for example, for the production of prints as groundwork for documents, bonds, securities, &c., in so far as it is a question of multiplying of forming patterns with repeat designs or figures. As these impressions depend not only on the diaphragms, but also on the arrangement of the openings in the perforated plate, imitation is almost impossible.

SZCZEPANIK'S SYSTEM OF COLOUR PHOTOGRAPHY.

[Patent No. 7729 of 1899.]

If a plate, *e* (hereinafter for shortness called a line plate), provided with fine transparent lines, is placed between a matt screen, *a* (fig. 1), on which the image of the object, *b*, is to be projected, and an objective, *c*, in which a diaphragm, *d*, provided with a square opening, has been placed, then the image appears on the matt screen in bands or lines which correspond to those of the line plate. If the line plate is moved further and further from the matt screen, then the bands forming the image become broader and broader, until, when a certain distance is reached, the lines or bands of light unite to form a sharp, unbroken image, which is, of course, less illuminated than an image projected without a line plate. If, instead of the diaphragm with the square opening (fig. 2), a diaphragm (fig. 3) is inserted, the opening of which has the same height as that of the diaphragm shown in fig. 2, but has less breadth, then, again, the image is less illuminated. If, whilst the other conditions are kept the same, a diaphragm is inserted which, in the vertical direction, is only one-third open (figs. 4, 5, or 6), there are, again, formed on the projected image black lines or bands, which are twice as broad as the light ones. Thus the width of the lines or bands of light is in direct proportion to the height of the opening in the diaphragm if the distances of the line plate from the objective and the matt screen remain the same.

A consideration of fig. 1, in which are shown the limiting rays corresponding to the several diaphragms shown in figs. 4, 5, and 6, will make the phenomena just described completely clear.

The transparent lines, or the line plates themselves, may have any desired positions (for example, vertical or oblique) if the diaphragm be arranged to correspond. The line plates, instead of having straight transparent lines (fig. 7), may be provided with wavy or zigzag lines (fig. 8 or 9 respectively).

As has been stated, when a completely open diaphragm (fig. 2) is used, a complete image is obtained. A complete photographic image can also be produced by means of the three partly open diaphragms (figs. 4, 5, and 6), if they are used one after another in the manner hereinafter described.

Together with each separate diaphragm, a colour filter (1, 2, or 3) of the kind used in three-colour printing is arranged in front of the objective, and in the end a sharp negative is obtained, which, in consequence of the employment of three diaphragms, exhibits three times as many lines as the line plate. The picture will thus consist of successive groups, each composed of three lines, which, on the negative, are of course monochrome, but in different shades corresponding to the red, yellow, and blue colour filters 1, 2, and 3 respectively.

The same result is attained if, instead of three diaphragms one after another, a single diaphragm (fig. 10) is used, the opening of which is provided with filters of like height for the red, yellow, and blue rays, arranged one above another.

If a diapositive or transparency (hereinafter called a diapositive) is produced from the negative that is obtained, a coloured image, representation, or picture, can be projected by means of the apparatus shown in fig. 1. In this case, *a* represents the diapositive, *e* (as formerly) the line plate, *c* the objective, *d* the diaphragm (with red, yellow, and blue plate). In front of the diapositive a condenser, *f*, of known kind, is arranged, and at *b* the coloured image, representation, or picture is produced. It is evident that the line plate, *e*, must occupy exactly the same position in relation to the diapositive as it did in relation to the negative during taking, since otherwise it might come about that, for example, the yellow rays impinged on the red filter. To remove this defect by adjusting the line plate is very difficult. Another device is, therefore, provided by means of which the correct adjustment can be effected without displacing the line plate. This device consists of a diaphragm which, as is shown in fig. 11, possesses, in addition to filters for red, yellow, and blue (1, 2, and 3 respectively), as shown in fig. 10, two other filters, one above and the other below this group of filters, the

Fig. 1.

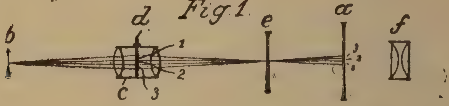


Fig. 2.

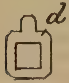


Fig. 3.

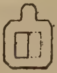


Fig. 4.

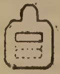


Fig. 5.

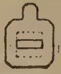


Fig. 6.

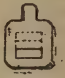


Fig. 10.

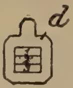


Fig. 11.

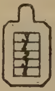


Fig. 12.

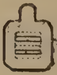


Fig. 7.

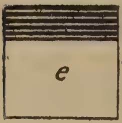


Fig. 8.

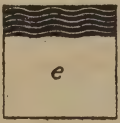
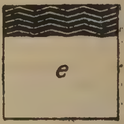


Fig. 9.



upper one being for the blue, and the lower one for the red. By shifting such a diaphragm inside the objective vertically, the defect hereinbefore mentioned can be removed, as this diaphragm permits of three different serial arrangements of the colour filters—namely, red, yellow, blue (1, 2, 3); yellow, blue, red (2, 3, 1), and blue, red, yellow (3, 1, 2). The shifting of the diaphragm may be effected by means of a screw or in any other suitable way.

As already stated, an image or picture projected in the manner described contains three times as many lines as there are in the line plate, and each three successive lines appear in the three fundamental colours (red, yellow, and blue). These lines are, however, so closely packed together that the eye cannot distinguish them separately, and thus the desired colour is attained.

The image or picture is the better the more closely the lines are packed together on the plate, *e*. The production of such closely lined plates, however, is limited by commercial and technical considerations. On the other hand, the number of lines composing the image can be increased by further division of the diaphragm. The opening in the diaphragm may be divided, for example, into six or nine parts, instead of three, so that two or three times as many groups of lines (each consisting of three-colour lines) appear as in the case of the tripartite diaphragm. A single diaphragm having its opening divided into six parts is provided with two groups of colour filters, one above the other, and each such as shown in fig. 10; fig. 12 shows by way of example one of three separate diaphragms to be used one after another instead of a single diaphragm provided with six colour filters as just described, the diaphragm shown being provided with two colour filters for yellow rays. A negative produced with a single diaphragm having six colour filters, or with three diaphragms of the kind illustrated in fig. 12, thus contains six times as many lines as there are in the line plate, and is therefore much more accurate than a negative produced with the tripartite diaphragm.

If the line plate is made of suitable thickness and provided at the back with a layer sensitive to light, this plate can serve at the same time as a photographic plate. Inversely, the photographic plate can be provided with fine transparent lines on a dark ground on the side away from the light-sensitive layer. Such a plate also forms a means of producing pictures or images in natural colours. When employing such a photographic line plate the distance of the light-sensitive layer from the lined surface is always the same; the plate must therefore be kept exactly at the same distance from the objective when projecting as when taking.

FILM PHOTOGRAPHY: MACAIRE'S SYSTEM.

APPENDED is Mr. Macaire's description of his invention:

I take a sheet, band, or reel of backing paper, which should be of good manufacture, and made from pure rag pulp. Upon this I spread, by any convenient means or apparatus (such, for example, as the machines employed in the manufacture of fancy papers, which are so well known as to require no further description), a coating, or it may be two or more coatings, of a mixture of gelatine and barium sulphate, the gelatine being rendered insoluble by chrome alum or other suitable agent; or, instead of gelatine for this coating, I may use any other suitable colloidal substance capable of being rendered insoluble; or I may first apply a coating or coatings of a mixture of soluble gelatine or other suitable colloidal substance, and barium sulphate, and, when this is dry, superpose thereon a coating of insoluble gelatine or insoluble colloidal substance. After allowing the coating last applied to dry, I apply an impermeable coating of wax, rubber, gum, resin, or the like, dissolved in benzine or other solvent, and, after allowing the solvent to evaporate, I apply a coating of collodion, or, by preference, alternate coats of collodion and gelatine or casein until the desired thickness has been obtained. This may be effected by dissolving the gelatine in water or casein in alcohol. The gelatine or casein should be rendered insoluble in water by the addition of a suitable agent, such as formalin. The outermost coating should contain the sensitising material or serve as the carrier therefor.

There is a special advantage in applying alternate coasts of collodion and gelatine or casein in the manner above described, since I thereby obviate any stretching of the film lengthwise or transversely.

I prefer films having upper coatings of collodion and gelatine or casein as described above the impermeable layer above referred to, but I may employ celluloid in place of the coats of collodion and gelatine or casein. For this purpose I may apply one or more coats of celluloid upon the impermeable layer, according to the thickness desired. The celluloid will be applied in solution in a suitable medium such as acetate of amyl and acetone with benzine. The outer layer is sensitised as before.

The paper backings which I employ are by preference black or of non-actinic colour. This has the great advantage of enabling rolls of film to be introduced in broad daylight into or removed from film cameras, and in the case of packets of film of preventing the daylight passing through the paper or other backing of a film exposed thereto and injuring the films behind. Halation, which is so serious a matter in producing photographic images for enlargement and the like as hitherto upon glass backings, is also thus prevented.

Any suitable apparatus may be employed for applying the various coatings to the paper backing, and when these have all been applied the band or sheet may be cut up into sizes suitable for the requirements of the photographic trade.

The films, after being exposed in the camera upon their backing, may be stripped therefrom and developed, intensified, reduced in intensity, fixed, washed, and finished, just as if they were upon glass, so that it is possible to readily follow and control the progress of these various operations, and thus obtain greatly improved results.

After washing and finishing the exposed film I prefer to pass it into a solution consisting of glycerine five per cent., formalin five per cent., water and alcohol. The film is then placed upon the original paper backing, which may be retained for the purpose, and allowed to dry in the air; this will impart perfect rigidity and smoothness to the film. When it is dry, it may be again stripped from the backing, and the result is a perfectly bright and rigid film entirely free from grain.

The films are particularly adapted for advertising and decorative purposes, since the difficulty experienced hitherto of enlarging transfers such as are required for the purpose, and which difficulty is due to the transference of the grain of the paper backing, is obviated. In employing my improved film for advertising or decorative purposes, it is only necessary to moisten the film and cause it to adhere to the desired surface, say, a painted iron tablet, by placing the gelatine face inwards thereon, and applying pressure. The paper backing may then be stripped off, leaving the film adhering firmly and evenly to the surface. The film should then be varnished.

The film may, if desired, be strengthened after exposure and finishing, by a surface layer of gelatine applied thereto in the well-known way.

RECENT NOVELTIES IN APPARATUS, &c.

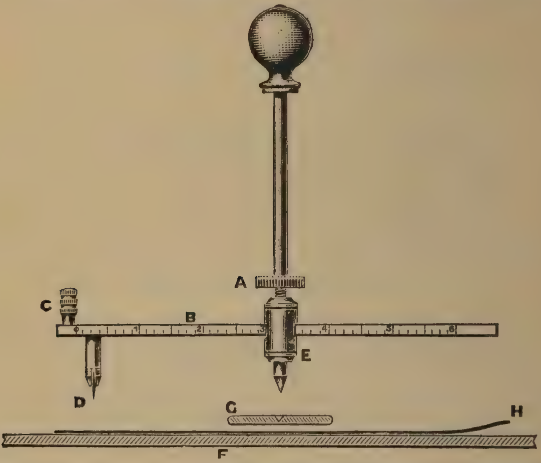
BY THE EDITOR.

[*These notices are confined as far as possible to apparatus introduced since the publication of the last Almanac. In all cases the various articles have come under our personal examination, a rule from which we allow no departure.*]

THE BEAM CIRCULAR PRINT TRIMMER.

Geo. Houghton & Son, 89, High Holborn, W.C.

THIS is a simple and accurate little machine for cutting circular photographs. The method of using it will be obvious by a glance at the illustration. The beam, B, which is graduated in one-sixteenths of an inch, can be instantly set by means of the locking head, A, to any designed range from seven-eighths of an inch to six inches radius, and therefore circles from one-and-three quarter inches to twelve inches diameter can be cleanly cut with one sweep round.



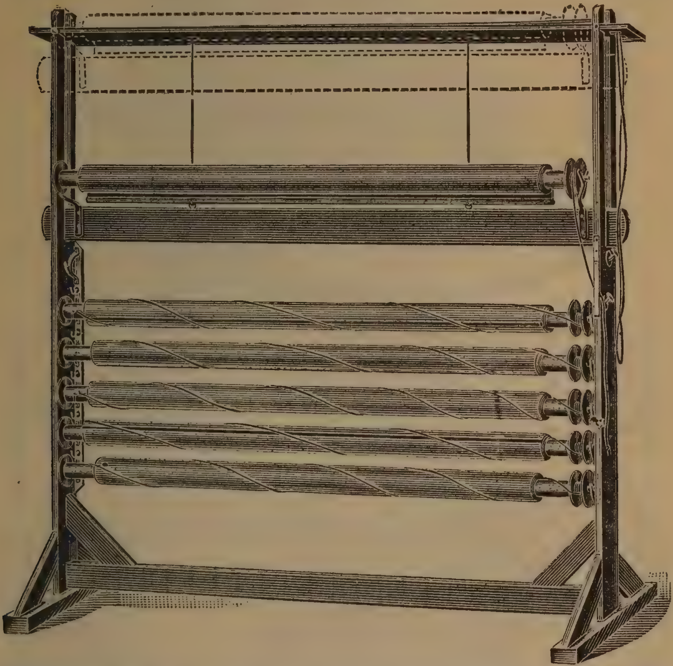
A one-and-a-half inch diameter plate glass circle, with a hole drilled partly through the centre, and the underneath part ground to prevent it slipping, is supplied for the instrument to revolve upon, and the work clamped underneath is thus always in sight. For repetition work of a fixed size the position of the centre can be made to coincide each time with a predetermined point on the subject to be cut, thus guaranteeing an exact reproduction.

All the parts are interchangeable, therefore the cutting wheel, or any other parts, can be replaced by new ones in case of accident, wear, or loss.

THE HOLBORN BACKGROUND STAND AND RACK.

Geo. Houghton & Son, 89, High Holborn, W.C.

In use, a background on a roller is attached to a sliding bar, which can be raised to any height, up to eight feet, by means of a double cord, or it can be fixed at any point by means of a side hook. Briefly, the



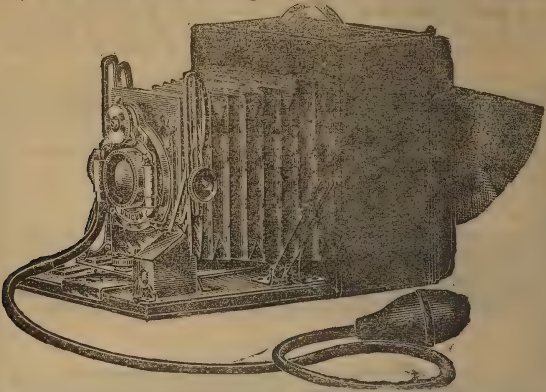
background can be lowered from the top like a blind, or fixed in any other desired position. The system is easy and noiseless to work.

Three rollers, with pulleys attached, and three sets of rack fittings, are supplied with each stand, but any number of extra rollers, &c., can be had if required. Three iron rods are also included for inserting in the bottom hem of backgrounds to weight them.

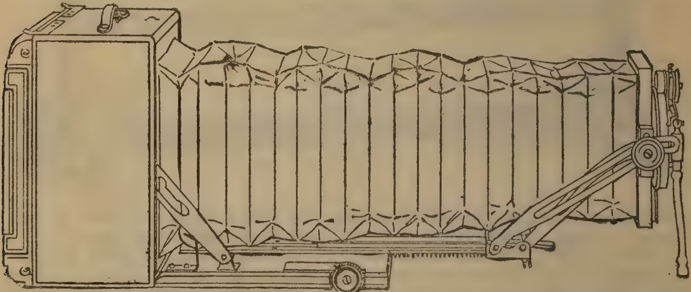
THE SANDERSON HAND CAMERA.

Geo. Houghton & Son, 89, High Holborn, W.C.

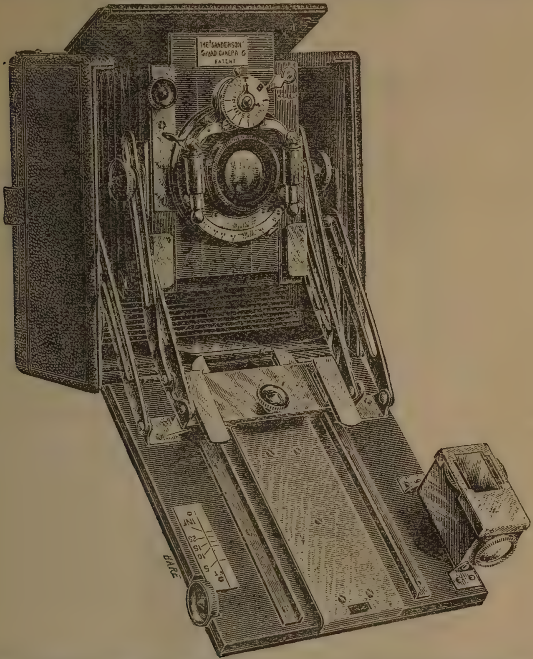
Available, as the illustrations show, either in the hand or on a stand, the Sanderson Hand Camera permits of lenses of very great focal length being used, or, by a baseboard adjustment, the front of the instrument may be brought as near as two inches to the focal plane. For use as a hand camera (fig. 1): The front is rigidly fixed in an upright position, and it can then be drawn out and focussed, an engraved scale being provided for the purpose. For use as a stand camera (fig. 2): By raising the front, it is freed from the rigid supports provided for hand-camera



work, and the universal movement is at once obtained by means of the slotted arms. The great rise of front which is then obtainable is of special advantage for architectural work in confined spaces, and does away entirely with the tilting of the camera and the necessity of swinging the back. The extension (fifteen inches in the quarter-plate size) is produced by means of the travelling frame in conjunction with the slotted arms (fig. 2), sufficient to use the single combination of a doublet lens



or for copying to the same size. To describe the instrument fully: The camera is of polished mahogany, covered externally with fine grain leather. It is fitted with removable focussing screen with spring hood, reversing back, rack and pinion, and engraved focussing scale. The lens is of doublet form, with iris diaphragms, and working at *f*-8. The shutter is the "Bausch and Lomb Unicum," working between the lenses, and giving a varying exposure of from one second to 100th part of a second, either by hand or pneumatic release. Time or ball exposures are also obtainable, the shutter in the latter case remaining open as long as the ball is pressed. The finder is of the brilliant form, and shows the image the correct way up without distortion. The double dark slides supplied with the quarter-plate and 5×4 cameras are of solid pattern with vulcanite shutters. Eastman cartridge roll-holders can be easily, adapted to the cameras, fitting into the same groove as the slides, and being in perfect register with them. The third ilustration shows the baseboard dropped out of the way when used with a wide-angle lens. This movement allows of wide-angle lenses of three inches, or even shorter focus, being used. It does not complicate the camera in any way, and simply entails making the side struts supporting the folding baseboard a little longer than usual. When opening the camera for use, the baseboard falls naturally into the normal position, *i.e.*, at right angles to the back, and, should the wide angle movement be necessary, all that is required is to press in the side struts and allow the baseboard to fall into the position shown in the illustration. Before doing this, however, the lens and front should be drawn forward on to the folding baseboard, and, after dropping the front, the lens can then be brought into the correct position by means of the universal swing front.


THE "SANDERSON" HAND CAMERA Co PATENT
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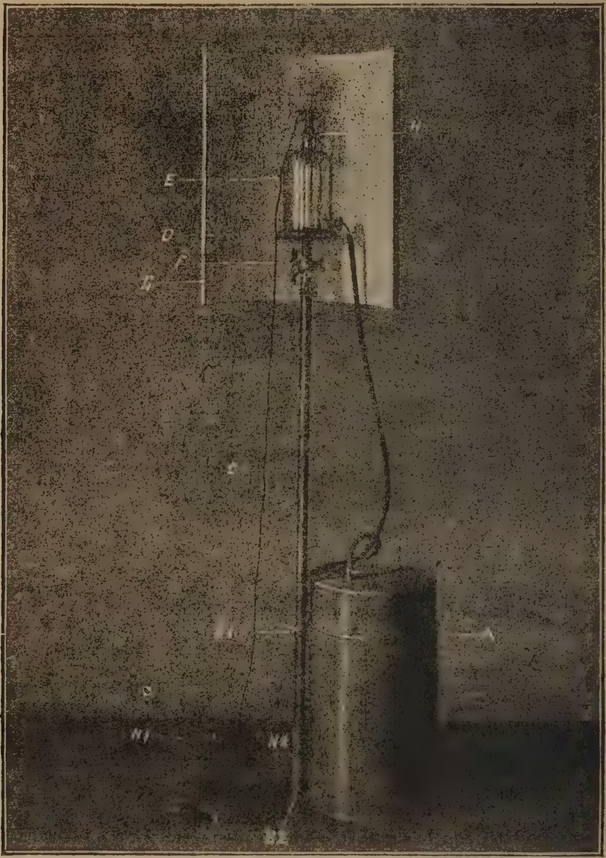
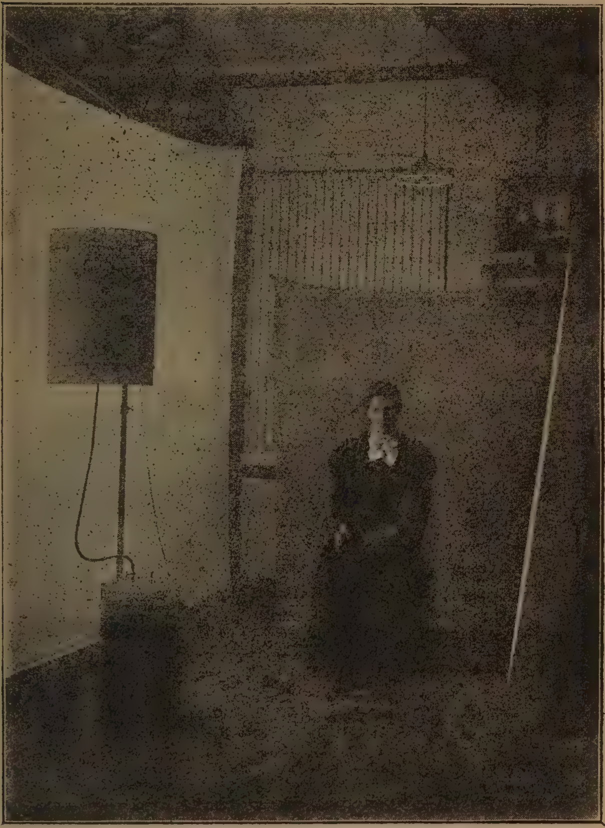
THE PLATINOTYPE COMPANY'S PORTRAIT LAMP.

In the Journal on several occasions we have referred to the new oxy-magnesium lamp of the Platinotype Company, and its adoption for portrait purposes in the studio. We have seen many photographs produced by the light, which, in softness and naturalness of effect, are not excelled by pictures made in diffused daylight. Appended we give a full description of the system. The first illustration shows the whole of the apparatus, which is exceedingly portable and can be easily stowed away



in the corner; the second shows the method of using the light by reflection.

The apparatus consists of an oxygen gas-holder, A, with two sockets, B¹ B², to hold a telescopic rod, C, to the top of which is fixed a wooden table, D. On this is placed the glass vessel, E; below the table, D, is an adjustable socket, F, holding the reflector, G. The glass vessel is connected with the gas-holder by a rubber tube, one end being attached to the stop-cock on the top of the gas-holder, the other to a bent tube,



passing through a rubber cork in the opening at the base of the glass vessel.

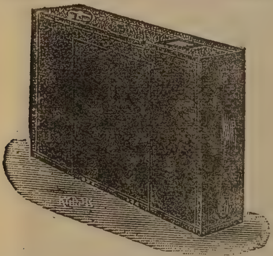
A rubber stopper is placed in the neck of the glass vessel; through this stopper a metal rod passes with a screw clamp to hold the magnesium ribbon. On opposite sides of this rod are two smaller rods, to which are attached two brass caps fixed to the conducting wires, the other ends of these wires being fixed to the battery at points. A switch is provided, by means of which the magnesium is ignited.

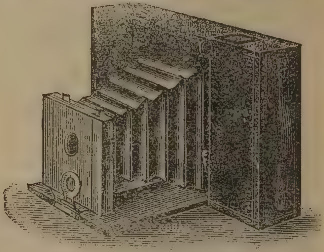
For the method of working, the principal directions are as follows:—1. See that the inner vessel of the gas-holder, A, can be raised and lowered freely. 2. Open both stop-cocks to allow the air to escape. 3. Put sufficient water into the tank, A, to just cover the top of the inner vessel. 4. Turn off one stop-cock, and to the other attach a tube from a cylinder of oxygen, allowing the oxygen to pass into the vessel, A, until the top of the inner vessel rises about six inches above the rim of the outer vessel. This will take about half a foot of gas. 5. Shut off supply from the oxygen cylinder, turn off stop-cock and disconnect the tube. After the insertion of the magnesium in the holder (simple directions for which are also given) the apparatus is ready for use. By pressing the button at the end of the push the electric circuit is completed, which causes the fine wire to become hot enough to ignite the fuse at the end of the magnesium, which then burns, giving a light of great actinic power.

THE No. 2 FOLDING BULL'S-EYE KODAK.

THE No. 2 Folding Bull's-eye Kodak, while taking pictures of the size $3\frac{1}{2} \times 3\frac{1}{2}$ inches, closes up to $1\frac{3}{4}$ inches in thickness. It is on the cartridge system, and takes a spool of film for twelve exposures. It is provided with a removable spool-holder, which renders the operation of recharging the camera simple and easy.

Constructed of wood covered with leather, this Kodak is extremely light, and is carried by means of the handle attached to the end of the camera, or it may be slipped into an overcoat pocket. Stand as well as hand work may be undertaken, as the baseboard is provided with socket for tripod screw. The size of the camera closed is $1\frac{3}{4} \times 4\frac{5}{8} \times 7\frac{1}{8}$ inches, the weight, 15 ounces, and the length of focus of the lens, $4\frac{1}{2}$ inches. The levers controlling the stops and time exposures are conveniently situated, and a third lever, actuating the shutter, is simply pushed to right or left alternately for snap-shots.



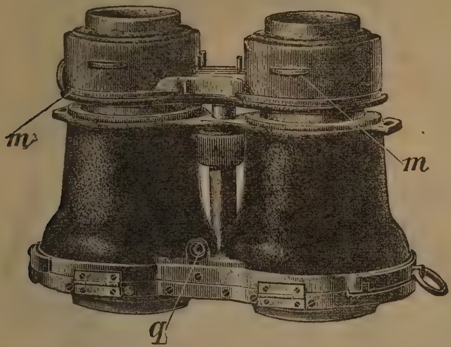


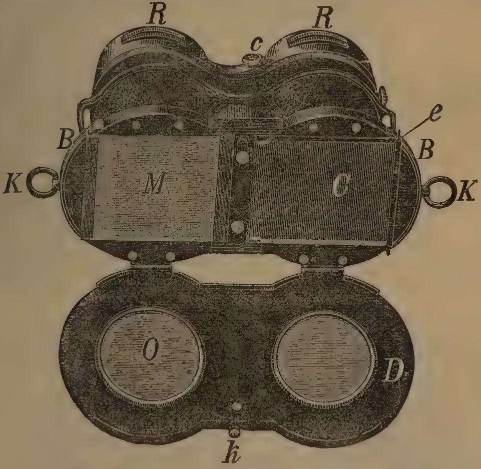
THE GOERZ PHOTO-STEREO BINOCULAR.

C. P. Goerz, 3 & 4 Holborn-circus, E.C.

THIS instrument fulfils the three functions of opera glass, field glass, and photographic camera, monocular or binocular. The first of the two illustrations shows it closed up, *m* indicating revolving diaphragms, and *q* the lug for attaching the camera to a stand. The second illustration shows the back of the instrument, carrying the binocular lenses, let down, and giving a view of the ground glass, M, and the plate-holder, C.

K, K pull out the sliding frames, B, B, in which the plate-holders are placed; R, R carry the binocular eyelenses and the camera objectives. A shutter is actuated at C. The plate-holders are of thin sheet metal and take plates 4½×5 cm. By one or two simple adjustments of pegs situated near to C, but not visible in the block, the camera is adapted for either monocular or binocular work. The image may be focussed and very rapid exposures given. When K is drawn out the shutter covering the plate is removed, and after exposure K is pushed back and the plate-holder easily removed. The movements for converting the instrument from a camera into an opera or field glass are simple—indeed, in changing the instrument from binocular to camera or vice versa no unscrewing or separating of the parts is necessary..

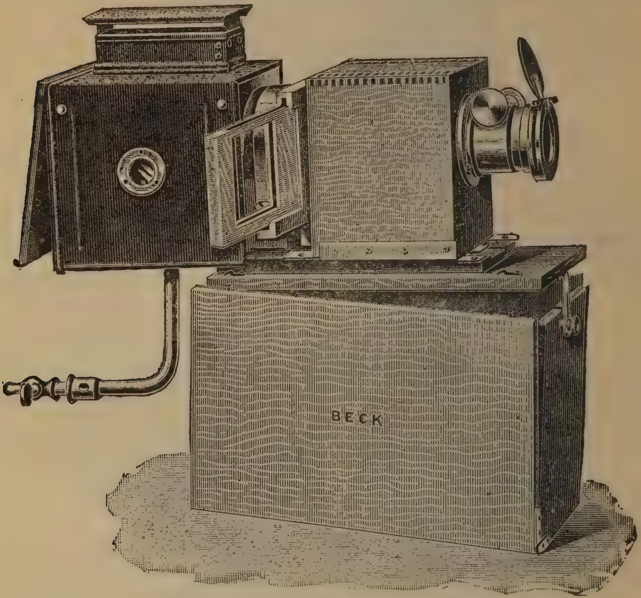




THE "LUVEX" LANTERN.

R. & J. Beck, Ltd., 68, Cornhill, E.C.

THIS lantern has been arranged for ordinary house gas in connection with the Welsbach burner; the only operation necessary is the joining up of the tube to a gas supply. The polished mahogany box into which the lantern is packed away measures 12 inches by 8 inches by 7 inches over all, and in it there is also room for the slide-carrier, cowl, and incandescent attachment. The lantern, when extended, measures 2 feet by 1 foot 6 inches by 7 inches. The box which contains the lantern has a hinged lid, which enables the instrument to be tilted. To put the lantern away, the objective is unscrewed and rescrewed in position on its flange inside the mahogany chamber which is then pushed up as far as possible towards the condenser. The slide-carrier having been removed, the square iron body is then slid upwards off its brass support, reversed, and pushed down on the same support, but in a reversed direction, over the condenser, mount, and mahogany chamber. When this operation is completed, and the cowl taken off, the lantern measures 7 inches by 6½ inches by 5 inches. The lantern is then unscrewed from the tilting lid and slipped into the box, when there will be found to be room for the slide-carrier, Welsbach attachment, gas bracket, iron cowl, &c. The "Luvex" tracing-paper screen is made of paper, and is mounted on a spring roller, so that it is always kept in good condition. When wanted for use it is simply pulled out by



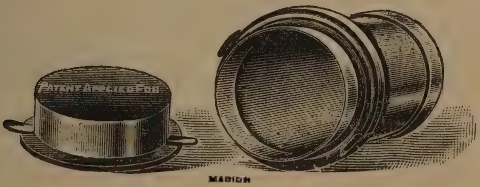
the top lath, and, being fully extended, the side laths are fixed and the feet spread out. When closed, it is in the shape of a long compact box.

The screen is 3 feet 6 inches square, a convenient drawing-room size.

A STORAGE TUBE FOR PLATINUM PAPER.

Marion & Co., Soho-square, W.

A very slight turn enables the lid of this tube to be removed, and, like the receptacle at the bottom which contains the calcic chloride, it is deeply sunk on the main tube, so that every precaution is taken to keep the platinum paper in a dry condition. The tube is neatly but strongly made and japanned black.

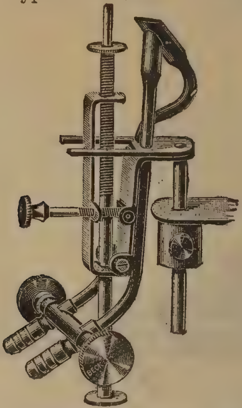


THE BYNOE LIMELIGHT JET.

R. & J. Beck, Ltd., 68, Cornhill, E.C.

THIS jet is intended for use with the New "Luvex" Lantern, or any lantern with overhanging body, in which it is desired to use the lime light instead of the incandescent gas light. It is pointed out that this is necessary when a large screen is used, or when a lantern is used for demonstration in a partially illuminated room.

Lanterns of the above type do not admit of the use of ordinary jets, as they project beyond the back of the lantern, and, besides illuminating the room, are liable to get moved out of the centre with the slightest touch. In the Bynoe jet there are no cog wheels to get clogged, and the adjustments are simple and cannot get out of order. Screw-down valves are fitted instead of ordinary stop cocks, so that the gas can be regulated with the most delicate precision, and, when once right, there is no chance of it being accidentally altered.



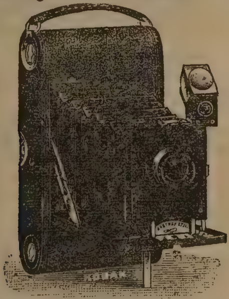
THE PANORAM KODAK.

Kodak, Ltd., 43, Clerkenwell-road, London, E.C., and branches.

THE Panoram Kodak was introduced to the American photographic public last year, and in the JOURNAL, over a year ago, we wrote appreciatively of some half-tone reproductions that we had seen from negatives made in the new camera. The appearance of the clever little instrument on the English market has been well timed, for it is the kind of camera which the autumn tourist, in particular, may be trusted to scan with a covetous eye. The narrow view, 7 × 2½ inches, including an angle of considerably over a hundred degrees, and looking so much, if we may so express it, like a rectangular slice out of a natural scene, is just the kind of photograph upon which the gaze of the traveller would approvingly rest. The eye, in lens parlance, is a mid-angle instrument; but, when it comes to human consciousness, as distinct from human perceptiveness, it is another thing altogether We most of us see, or think we see, panoramically, and photographs that are taken by means of a mobile optical system seem to have, with the majority of people, a far more satisfying effect than views of less extensive angular inclusion. The

Panoram, we may state for the information of those who have not yet tried it, is absolutely no more trouble to work than any other camera of the Kodak series. The film is bent round a curved surface, thus presenting a concave field to the lens. The shutter being set by the movement of the lever on top of the camera, the front flap is dropped, and, the centre of the image being located on the finder, the exposure is made by the pressure of a metal button, which releases a spring that allows the lens to swing concentrically to the curved film. This is really all the photographer is called upon to do, and it will be seen that it differs very little from the familiar Kodak formula. Besides the finder, the camera has a spirit level, and the shutter has two speeds, quick and slow instantaneous. The Panoram Kodak is a beautifully finished little machine, and it is well worth the 50s. charged for it.

The series of Kodak cameras has been further extended by the inclusion of a "No. 3 Folding Pocket Kodak." This takes 4¼ × 3¼ size photographs either vertically or horizontally, has a doublet lens, focussing scale in yards and meters, can be used on a stand, is fitted with a finder, gives time and instantaneous exposures, and admits of the use of glass plates. Withal, there is no sacrifice of portability as compared with other cameras of the folding pocket series. The quarter-plate Kodak should be welcomed by the devotees of "regular sizes," and it is sure to be appreciated for its compactness and convenience.



THE CORNEX FINDER.

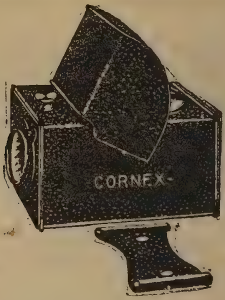
R. & J. Beck, Ltd., 68, Cornhill, E.C.

The construction of the Cornex Finder is such that the amount of view included in it is stationary, and remains so from whatever position it is observed.

The shade which is provided to prevent the reflection from the top lens folds down when not in use and protects the lens from injury.

At the back of the front lens an oblong mask has been placed, which can be revolved by turning the small knob on the top of the finder, and by this means a vertical or horizontal view is seen.

For attaching the finder to the camera two separate metal carriers are provided. It is recommended that one of these be screwed on to the top and the other on to the side of the camera, in the required position. It is then only necessary to press the finder down on to whichever carrier is to be used, and it will be held firm and in position by the springs at the sides of the carrier.



"LA PETITE" LIVING PICTURE CAMERA AND PROJECTOR.

W. C. Hughes, 82, Mortimer-road, Kingsland, N.

THIS instrument is well named, for within the compass of an ordinary-sized hand camera you have the entire apparatus for taking and projecting animated photographs. It is well made, and the mechanism for passing the film across the focal plane is ingenious and simple. A good idea of the construction of "La Petite," and the manner in which it is worked, will be obtained from the following condensed instructions for its manipulation:—

Taking.—Set the camera tripod on firm ground, so that it is perfectly rigid, and, by means of a piece of plain matt celluloid placed in the film race, focus the object to be cinematographed.

Now open the front, and place the cardboard film into the recess. Pass the end of the film over the brass stay, then shut the door in front; turn the camera round, then pass the film through the race, and again over the brass projection at the bottom of pressure plate, so that the end is outside.

Next pass the film into the receiving box, and attach the end of the film to the hook on the brass revolving winder, then lock into position by the lever, care being taken not to buckle and catch the film in so doing.

When this is ready, stretch the rubber band on to the pulley, and the machine is ready.

The correct speed for all ordinary subjects is two turns per second.

Projecting.—Before starting see that the "La Petite" is quite central with the sheet, otherwise a distorted picture will appear.

The stand must be rigid, preferably screwed to the floor, so that there is absolutely no shake.

First adjust the light and throw a disc on to the sheet, then draw the light backwards or forwards until there is even illumination; if the size of picture is too small, draw the machine further back from screen until the size required is obtained.

If the oxyhydrogen light is being used, it is necessary to use an alum trough between the condenser and "La Petite," thus absorbing all the heat rays and preventing a possibility of firing.

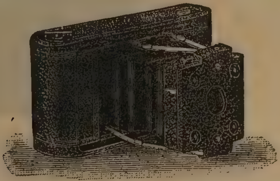
Now place the film in position on the holder, and thread through the race, and through the bottom of machine, so that it can drop into a box or other receptacle; close the door and turn the handle.

Should the film show the perforation at top or bottom of picture, alter it by means of the lever on door.

THE No. 1A FOLDING POCKET KODAK.

Kodak, Ltd., 43, Clerkenwell-road, E.C.

THE No. 1a Folding Pocket Kodak takes a film $4\frac{1}{4} \times 2\frac{1}{2}$ inches. It is of the usual folding pocket type, opening and closing with one rapid simple movement. It has an ever-set shutter, and separate levers for time and instantaneous exposures, while a third lever actuates a set of three stops. The dimensions of the No. 1a Folding Pocket Camera are: 8 inches long, $3\frac{7}{8}$ inches wide, and $1\frac{3}{4}$ inches thick when closed. It takes spools of daylight films for twelve exposures and for six exposures.



THE NYDIA POCKET CAMERA.

Newman & Guardia, Ltd., 90-92, Shaftesbury-avenue, London, W.C.

THE "Nydia" camera, when closed up, measures no more than $7\frac{1}{4} \times 4\frac{1}{4} \times 1\frac{1}{4}$ inches, and when loaded weighs under one and three-quarter pounds. Thus it may be comfortably carried in most coat or jacket pockets.

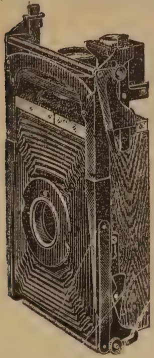
The body is the changing box itself. A set of light but very strong metal struts connects this with the front, and holds all parts rigidly set out when in use. The bellows is attached to the box, and by a simple device (a slight rotary movement) it can be instantly fixed to or detached from the back of the shutter, making an absolutely light-tight joint.

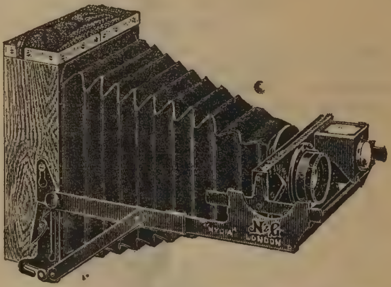
The whole operation of setting and refolding the camera takes only four or five seconds.

The "Nydia" is stocked fitted with four different makes of lenses, viz.:—French rapid rectilinear, *f*-8; Wray rapid rectilinear, *f*-8; Ross new symmetric anastigmat, *f*-8; Zeiss Satz anastigmat, *f*-6.3. These lenses are supplied in extra light and small cells, and the Zeiss anastigmat has been specially computed by the Jena Works for the "Nydia." All have the normal focus for quarter-plate—$5\frac{1}{2}$ inches. The "Nydia" mount is fitted with a frictionless iris diaphragm, and the scale is engraved up to *f*-45.

The shutter measures only $4 \times 1\frac{1}{2} \times 5\text{-}15$ inches, and is made entirely of metal and dust-proof. The blades work between the lens combinations, by a vertical slit. The action is smooth, there being no vibration with any exposure. The pneumatic cylinder is entirely enclosed, and the scale is graduated for automatic exposures of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, 1-16, 1-32, 1-64, and 1-100th second—all tested. Time exposures can also be made.

The finder is of the real image type, and very light; it gives a picture $\frac{11}{16}$ths × $\frac{1}{2}$ inch. It can be quickly changed from the vertical to the horizontal position by merely sliding it in and out of its spring holder. The camera has the full range of focus from two yards to infinity. A lever and scale enable the worker to alter or fix the focus in an instant. The friction of the guide-plates is adjustable.





The magazine of the "Nydia" is similar to the "N. & G." changing-boxes. The boxes are made in two forms: No. 1, for twelve cut films only; No. 2, for eight plates or eight films. Any kind of $4\frac{1}{4} \times 3\frac{1}{4}$ films or plates may be used; the latter, however, must be coated on thin glass.

The boxes are all interchangeable, and easily fixed to and detached from the camera, so that, by using several boxes, the number of exposures a photographer can make without resorting to a dark room is practically unlimited.

A vertical swing of ample latitude is provided by the metal framework.

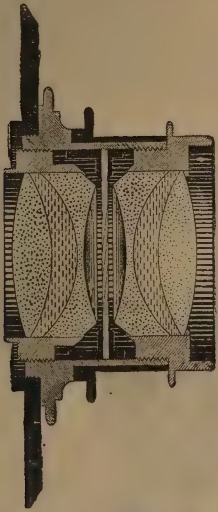
THE BECK-STEINHEIL ORTHOSTIGMAT LENS

R. & J. Beck, 68, Cornhill, E.C.

The lens possesses the full working aperture of f-6.3 in the smaller sizes to f-6.8 in the larger, and considerably more than covers to the very corners of the plates listed; in fact, although the No. 3 orthostigmat is listed as covering only a quarter-plate at full aperture, yet it might fairly be listed as covering a 5 × 4, or even a half-plate, at the aperture f-6.3.

The formula of the orthostigmats in common with most of the best modern anastigmats is such that microscopic errors in the workmanship of the twelve surfaces most seriously injure the quality of the finished lens. Messrs. R. & J. Beck have therefore introduced into their factory at Kentish Town a new method of manufacture and testing to ensure that the definition obtainable with this formula of lens should not in any way be diminished by errors in manufacture.

Each surface is polished and figured on the principle adopted for the manufacture of large astronomical telescope object-glasses. The tests employed are such that an error in a surface which does not exceed a fraction of a wave-length of light may be detected immediately; this accuracy entails of necessity the employment of the most skilled labour, and consequently an increase of price over lenses manufactured in the old way, compensated, however, by corresponding increase in optical quality. These new anastigmatic lenses, at present manufactured by Messrs. R. & J. Beck, Ltd., have foci varying from 3½ to 23½ inches, and covering plates from 3¼ × 3¼ to 28 × 24 inches. They are applicable to all kinds of rapid instantaneous work requiring the maximum definition with as large an aperture as possible, or for process work where speed, angle, and covering power are required.



THE "FORWARD" STUDIO CAMERA AND STAND.

O. Sichel & Co., 52, Bunhill-row, E.C., and 47, Oxford-street, W.

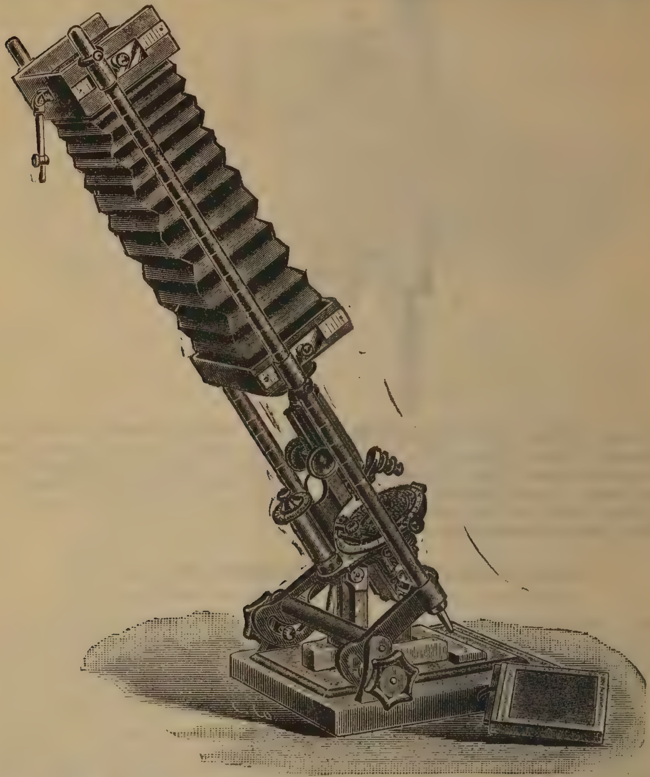
THE camera is made in mahogany with brass bindings, and the particular one we inspected was of walnut with nickel fittings, and we were much struck by its excellence of finish and construction. Whether in walnut or mahogany, it is fitted with a double swing and repeating back, which takes one back for slides, holding carriers for 8½ × 6½ and cabinet plates, and another back with roller shutters containing carriers for larger plates. The backs are easily fixed and removed by turning a screw or pressing them into a spring. The smaller back is fitted with a hinged focussing glass, and a focussing glass is supplied for the larger. It fixes in the same way as the back itself. The front part is movable. The lens can be lowered or raised, and is fixed in a very simple and ingenious way. The square bellows is supported by an arrangement which prevents sagging. The camera extends to double its natural length. The stand is of black ebonised wood, and is fitted with an easily controlled tilting system.

The camera has a range from a very short focal length to fifty-four inches, and works with the utmost ease and smoothness.

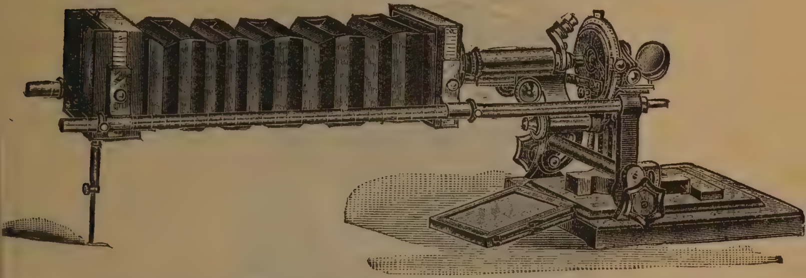
THE BAUSCH AND LOMB PHOTO-MICROGRAPHIC OUTFIT.

Agents: A. E. Staley & Co., 35, Aldermanbury, E.C.

Amongst the many specialities of the American house of Bausch & Lomb, for which Messrs. Staley are agents, may be mentioned the admirable photo-micrographic system shown in the illustration. The camera, which takes either quarter-plate or 5 × 4, has all the usual motions; the bellows gives an extension of twenty inches. The stand is solid, enamelled, with nickel fittings; there are double clamping screws for vertical or horizontal positions; adjustable supporting arm for camera, and double dark slide. The light-tight metal connections between micro- [illegible]



scope and camera are blackened inside and out. The microscope supplied is Messrs. Bausch & Lomb's newest model, with two eyepieces, and one-inch, two-thirds, and one-sixth objectives; sub-stage, with iris diaphragm and ray filter; triple nose piece; condensing lens, on stand; and Welsbach gas lamp, with metal chimney and iris diaphragm. The entire system is beautifully finished throughout, and we have much pleasure in bringing it to the notice of our readers, who will gain a clear idea of its external appearance from the illustrations.



THE CHALLENGE CAMERAS.

J. Lizars, 101 & 107 Buchanan-street, Glasgow.

Taking this series in order of reference, the new Challenge stand camera, which forms an item of a 70s. set, is now fitted with a time and instantaneous shutter with special indicator (fig. 1). The Challenge combination stand camera (figs. 2 and 3) is well named, for its uses range from very short focus work to copying. The back of the camera moves forward by means of a rack and pinion for the use of wide-angle lenses. The baseboard is also extended by the front rack and pinion, thus allowing of rack focussing for the whole extension. The front may be raised to bring the lens to the top of the plate or angled into any required position, as shown in fig. 2. The extension of the camera is such as to permit of lenses from 4½ to 16 inches focus being used. The Challenge

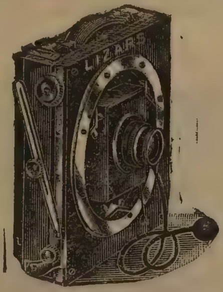


Fig. 1.

interchangeable hand camera, model D (fig. 4), takes either glass plates or rollable cartridges.

When plates are being used, the back part of the camera folds over the entire dark slide, and thus prevents the possibility of light getting at the sensitive plate when the camera is exposed out of doors. With this projection the shutter of the dark slide can be withdrawn, leaving the camera ready for immediate action. Model E (fig. 5) aims at extreme compactness, as may be understood from the illustration; it is fitted with a reversing back and a double extension baseboard, and takes either a roll-holder, a changing box, or slides. Model F (figs. 6 and 7) very skil-

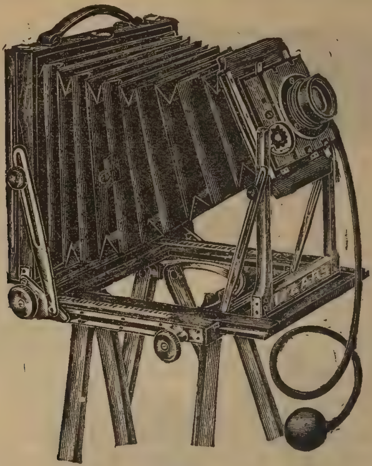


FIG. 2.

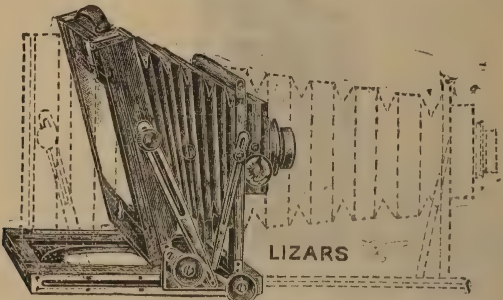


FIG. 3.

fully embodies the principle of triple extension. By an ingenious arrangement, the second base is used for ordinary work, and the triple base is only employed upon those occasions when the camera is to be racked out to its full extent. Mr. Lizars points out that the gain in rigidity of this latter system is considerable, as it overcomes at once any objection that might be made to a long-extension camera for ordinary work, for which

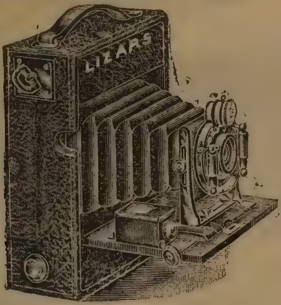


FIG. 4.

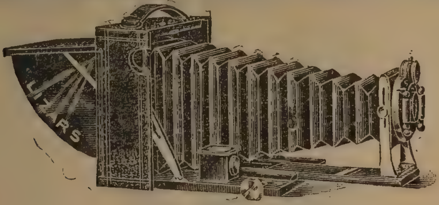


FIG. 5.

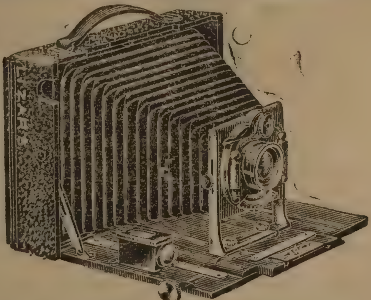


FIG. 6.

it is in every way as convenient as the short-extension models, whilst it is always available for copying, and for use with long focus and telephoto lenses when required. The rack acts upon both portions of the baseboard, which do not require to be set by hand, as in many models.

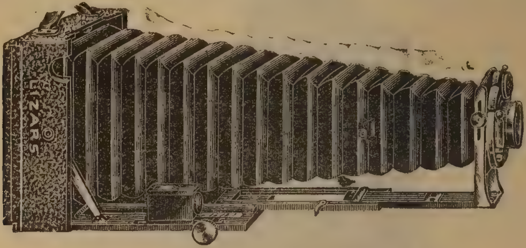
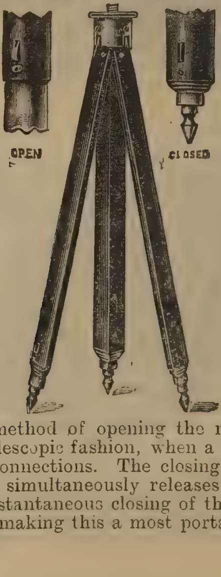


FIG. 7.

CAMERA TRIPOD OF ALUMINIUM OR BRASS.

Arthur Rayment, 125, Earlham-grove, Forest Gate, London E.

THE stand here shown may appear familiar to our readers, but upon close inspection it will reveal the fact that a new and decidedly advantageous locking and releasing device has been substituted for the well-known form, with internal and external springs, hitherto employed. The old form of outside spring is very liable to be pushed out of its place or broken. The method of opening the new stand is by simply drawing out the tubes telescopic fashion, when a duplex catch secures the rigidity of the jointed connections. The closing is effected by pressing the duplex catch, which simultaneously releases all the jointed connections, and permits the instantaneous closing of the legs to their minimum length of 14½ inches, so making this a most portable as well as light and convenient camera stand.



THE No. 8 PRIMUS CAMERA.

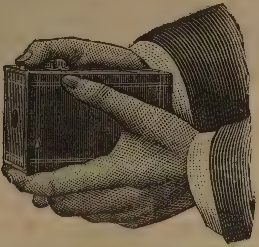
W. Butcher & Son, Blackheath, S.E.

THIS little instrument, with three double slides and a case, is especially designed for cycling photographers. When it is put into use it is so attached to a cycle that it may be removed from the case without unstrapping the latter from the machine. Of field-glass shape, the body of the camera, which is morocco-covered, may be compressed by the movement of two internal supports. It is made for quarter-plate pictures, and the sides are of the metal form devised some years ago by Mr. B. J. Edwards. The single lens, of about five inches focus, is controlled by a rotating diaphragm with three apertures, and the shutter, which is of the go-and-return variety, admits either of time or instantaneous exposures. The camera is light, portable, and well made. It has a view-finder, and the slides may be packed inside the camera when the latter is not in use.

THE BROWNIE HAND CAMERA.

Kodak, Ltd., 43, Clerkenwell-road, E.C.

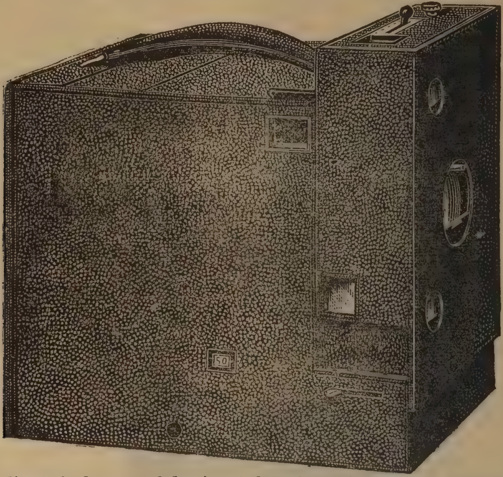
THE Brownie camera measures only 4⅞ × 3⅛ × 3⅛ inches; it weighs 8½ ounces. The lens has a focal length of 4 inches, and the size of the image given is 2¼ × 2¼ in. It takes daylight changing cartridges, transparent film or paper film being had as desired at 7d. and 5d. per spool of six exposures respectively. The instrument is neatly covered with leather cloth, the external fittings are of nickel, and in loading and exposing the film the well-known Bullet and Bull's-eye Kodak movements are availed of.



THE 5×4 "TELLA" HAND CAMERA.

The Tella Camera Company, Ltd , 110, Shaftesbury-avenue, London, W.

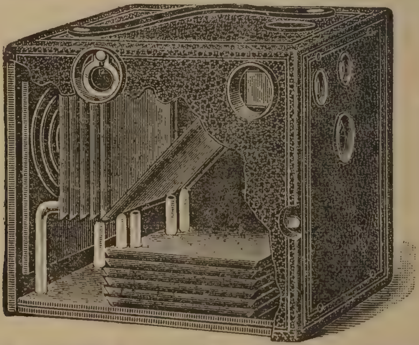
THE 5×4 size of plates or films, which at one time was very popular with amateur photographers, seems, after a period of comparative neglect, to be regaining much of its former share of notice, and the Tella Company, taking advantage of this circumstance, are making a feature of supplying the Tella Hand Camera in two sizes, quarter-plate and 5×4. Our most recent experience of this clever changing system, which removes an exposed film from the focal plane, places a new one in position, and indicates the number of exposures made, by the simple in-and-out movement of a sliding frame in the base of the camera, is that it works with unerring certainty. In the way of film-changing methods we know nothing so simple and effective. But the entire camera is a marvel of concentrated ingenuity applied to the prime purpose of imposing the least possible trouble on the photographer. Simple lever movements control the focussing scale, the lens aperture, and the speed scale. You set the shutter by pulling out one little rod, and the release is effected by a touch of the finger on another. A lens of high quality, two exceedingly brilliant finders, and horizontal and vertical fronts, summarise the remaining features of the "Tella" camera, which is beautifully finished, and so compact that its dimensions are kept within the small space of 9×7×5 inches.



THE CYKO HAND CAMERAS.

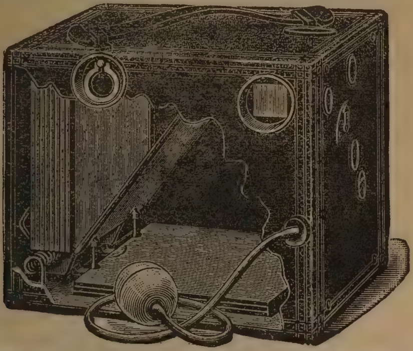
John J. Griffin & Sons, 20-26, Sardinia-street, Lincoln's Inn-fields, London, W.C.

The No. 4 Cyko is covered with black leather, is light, portable, and neat in appearance. It takes twelve sheaths, which easily fall into position, are securely held, and, when an exposure is made, a sheath is



released and dropped by the simple action of turning a small nickel ring on the outside of the camera. The remaining features of the Cyko camera are thus described:—

The lens is an achromatic combination meniscus. The shutter is very simple of construction. It is always set, requiring but a touch to make the exposure, automatically resetting itself without further effort. When one has made twelve exposures, one has only to open the camera at the back and draw out the tray carrying the twelve plates, which are removed by merely lifting them off.



The bulb release prevents possible jarring of the camera, a register shows the number of exposed plates, the plate-holders are made of aluminium, the diaphragms permit three different openings, with a cut-off, which, when set, locks the shutter and prevents accidental exposures.

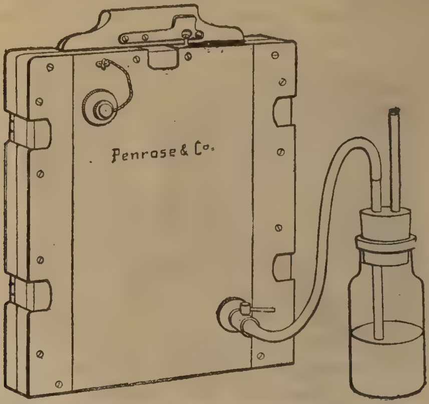
A DARK SLIDE FOR THE LIPPMANN PROCESS.

Penrose & Co., 8 and 8A, Upper Baker-street, London, W.C.

This Dark Slide has been designed for working the Lippmann process of photography in colours, and the construction follows the lines sugggested by Professor Lippmann, with some improvements tending to greater compactness and security against leakage of the mercury.

The slide is slightly larger each way, and somewhat thicker than an ordinary dark slide, and it only takes a single plate. It is made exceptionally strong to withstand the pressure of the powerful springs which made the holder mercury-tight. The essential feature of the construction is a steel plate, fitted at the back with a number of springs. To this plate are attached two tubes, passing to the outside of the slide. One is provided with a small stop-cock, to which is attached the rubber tube of the mercury bottle. The other is provided with a plug, and forms an air vent, which must be opened when the mercury is running in. The second tube of the mercury bottle also acts as an air vent when the mercury is returned to the bottle. On the surface of the steel plate is laid a frame of thick chamois leather, forming a margin of about ¼-inch width, and on this is laid the prepared plate, sensitised side downwards. There is thus a space between the steel plate and glass plate, which can be filled with mercury. In the operation of filling, the slide should be held vertical, and the mercury bottle held above the top of the slide. More mercury than is required to fill the slide should be contained in the bottle in order to get a good "head" to force the mercury up the slide. The flow must be steady and without intermission, or markings will occur on the plate. For the same reason the slide must be held steady.

A focussing frame is sent out with each slide, with the ground glass coinciding with the surface of the sensitive plate. Messrs. Penrose state that they cannot make their dark slide to match existing dark slides, which are generally much too small and light to compare with the Lippmann slide. It is usually best to adapt the latter to a camera next size larger.



MERRETT'S TRIMMING DESK.

Marion & Co., Soho-square, W.

THE instructions for using this trimmer are: Place the print on the desk, allowing the part to be trimmed off to pass under and beyond the steel band at the top, then, while holding the print in position, press the desk down as far as it will go. The cut is thereby made, and, upon releasing the pressure, the desk rises automatically, ready for the next cut. A rule gauge fitted to each desk ensures accuracy in cutting.

THE STEREOSCOPIC "BINOCULAR" CAMERA.

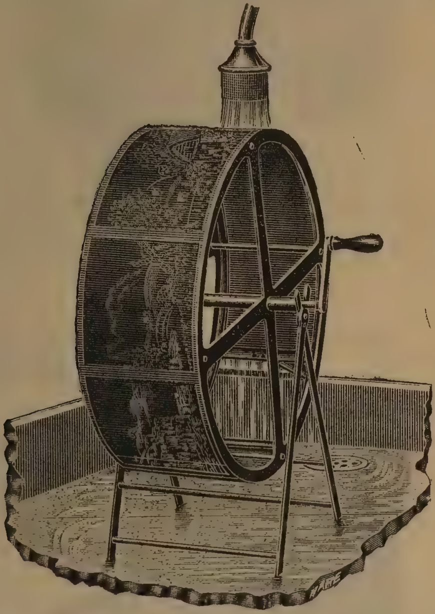
W. Watson & Sons, 313, High Holborn, W.C.

HITHERTO the little stereoscopic binocular camera which Messrs. Watson introduced some time ago has depended for its changing method upon the bag system, the exposed plate being drawn into a bag attached to the instrument. But, by a recent improvement, a sliding magazine has been substituted for the bag, so that the changing has been much simplified, and the convenience of the instrument enhanced. It is easily to realise the extremely simple manner in which changing is now effected. To do this, the camera must be held in a horizontal position, with the lenses showing upwards. Then the lower eyepiece, which carries with it the magazine, must be drawn out by the flange provided for the purpose. When fully drawn out, the exposed plate falls to the bottom, and the magazine must then be returned to its original position, the act of returning it recording the number of the exposure. When it is required to refill the magazine, two clamping screws at one side of the camera must be loosened, when the magazine can be entirely withdrawn; then, by removing a stop from one end of the magazine, the sheaths can be drawn or dropped out through the aperture that is provided.

THE "VOLO" DEVELOPING APPARATUS.

Geo. Houghton & Son, 89, High Holborn, W.C.

This simple piece of apparatus should be of great assistance to those photographers who employ rollable film for negative work. The printed instructions, however, may conveniently be quoted for the benefit of those not conversant with the principle of rotary development.

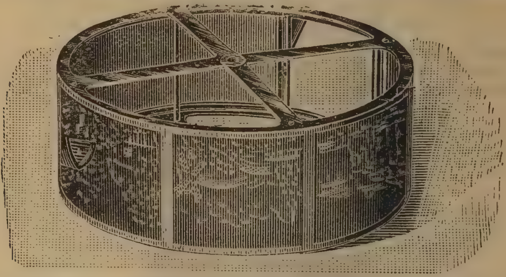


"Cut off from the spool the number of exposures that are to be developed, and attach the film, sensitive side outwards, to the wheel by means of a fixed clip, on the wheel. Pass the length of film round the rims of the wheel, and attach the other end to a loose or sliding clip. Any number of exposures can be developed at one time up to the number that the wheel will take, as this clip is movable, and can be fixed in any position on the wheel.

"Developing.—The film is now in position for development, and the wheel should be placed on the stand provided and revolved, the film passing through the developer with a gliding motion, which is most desirable for the avoidance of spots and streaks.

"Fixing.—This can be done in the same manner as for developing, or the handle and axle can be removed, and the wheel, with film upon it, placed in a bath of hypo. With the aid of another wheel the operator can then proceed to develop another set of exposures.

"Washing.—This can be done by placing the wheel on the stand in a sink, and allowing a stream of water from a tap, preferably fitted with a rose, to play upon it, causing the wheel to revolve, as shown in fig. 1; or, if preferred, the handle and axle can be removed, as explained before, and the wheel placed in a bath of water.

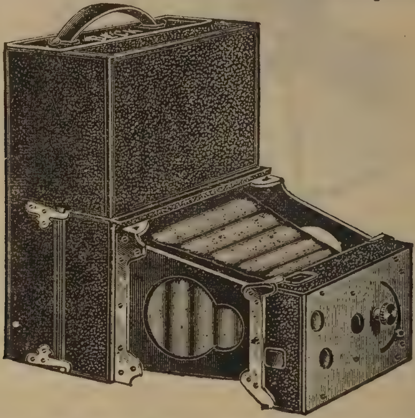


"Drying.—The wheel can be placed on its side (fig. 2), and the film left on until dry, when it can be removed and cut up for printing."

THE No. 6 FRENA.

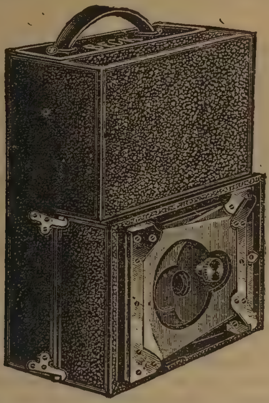
R. & J. Beck, 68, Cornhill, E.C.

This camera is smaller and more compact than the box form of Frena, and has the further advantage that glass plates in plate-holders may be employed if desired. The No. 6 Frena takes quarter-plate pictures. It has an achromatic single lens with a "fixed focus," whose range of focus includes any object between twenty feet from the camera and the horizon. The same system of magnifiers is used for focussing near objects as is

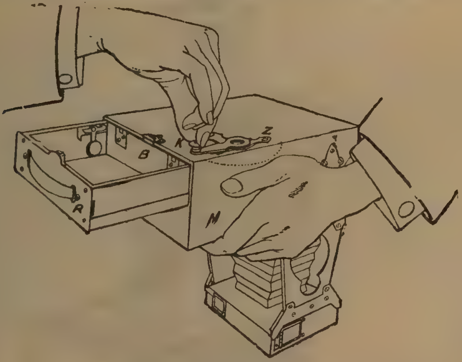


employed in all the fixed-focus Frena cameras. By means of these, objects as near as nine inches can be photographed.

The camera is fitted with two Brilliant "stationary" finders, has

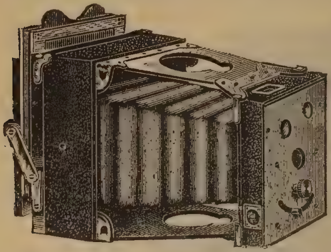


diaphragms to the lens, and shutter giving exposures 1-5, 1-10, 1-20, 1-40, 1-80 of a second and time exposures. The film-changing device is on



the Frena system, in which the films are dropped into a receiving chamber one by one as exposed. The construction of the film-changing portion is, however, different, the magazine holding the film being drawn out by a slide till it is opposite the receiver, the revolution of a handle then drops the exposed film into this chamber. An automatic indicator records the number of films thus dropped into the receiver.

By means of this new arrangement of the film-holder Messrs. Beck have been enabled to construct the Folding Frena so that the lens, shutter, and camera can be detached from the magazine and film-changing portion. In this manner the camera, with the addition of a ground-glass attachment and double plate-holder, can be used as an ordinary plate camera if desired.

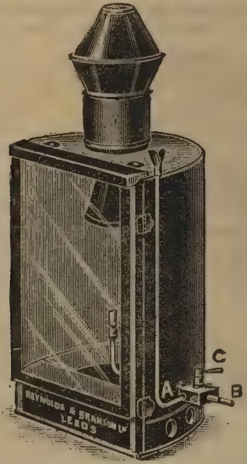


The camera is of a convenient shape to be slung over the shoulder, and can be easily used whilst still so slung.

THE "KRYSTOS" No. 3 DARK-ROOM LAMP.

Reynolds & Branson, Limited, 14, Commercial-street, Leeds.

Much experience in the use of dark-room lamps of varied orders of design and construction led us to direct particular scrutiny to the "Krystos," which Messrs. Reynolds & Branson have kindly brought under our notice. Of one of its features we can speak with especial praise, for very often in the course of an evening's work we find ourselves called upon to develop negatives and expose bromide prints and binocular transparencies. This lamp answers for all three purposes. As the makers point out, the special tap and arrangement of burners enables the operator to use either the jet inside the lantern for non-actinic light or instantly to alter this to an invisible light, and, by the same action,



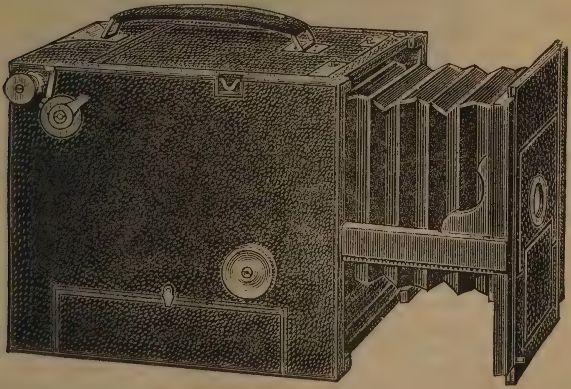
turn on to full the outside jet, which is then available for lighting the dark room, or for printing transparencies or bromide prints. By turning the tap to B, both jets are at once reduced to a by-pass light; at A, white light is obtained; and at C, non-actinic illumination. It is, therefore, easy to ensure instantly either actinic illumination, non-actinic light, or both jets turned to non-luminous lights. In order to ensure the latter, an adjusting screw is fitted to the tap, to enable the outside jet to be adjusted to invisibility for any pressure of gas. Another feature is the cone for keeping the body of the lamp cool, the hot combustion products being carried away in three separate channels. The lamp is japanned black outside and white within. It is neatly and strongly made, and decidedly convenient to use.

THE ADAMS REFLEX HAND CAMERA.

Adams & Co , 26, Charing Cross-road, W.C.

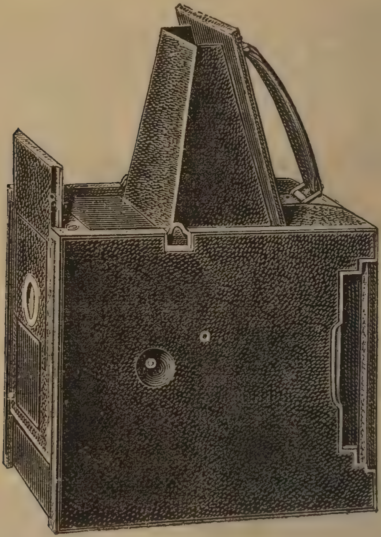
The Adams Reflex Hand Camera takes 5×4 pictures, and measures 9 in. × 8¼ × 6¼, with a weight of 6¼ lbs. The illustrations respectively show the camera entirely closed; extended for long-focus work, and with the funnel-shaped hood, 6½ inches high, opened for allowing of an examination of the finder image. The lens aperture is entirely controlled from the front of the camera, a small board being let down to allow of the diaphragm being revolved in accordance with an engraved scale. A focal range of from 6½ to about 13 inches is given by the camera.

The patent focal-plane shutter employed and the mirror are practically part and parcel of one system, for the movement that releases the mirror releases the shutter at the same time, virtual instantaneity and simultaneity being assured, and smoothness and noiselessness characterising the double motion. The method of controlling the shutter is exceedingly ingenious. The driving spring is always wound to its full tension, and the different speeds are obtained by varying the slit, command over which is obtained by means of a knob outside the camera. These speeds



are marked on the "blind," and are visible from the outside of the camera; they range from one-thousandth to one-tenth of a second, and time exposures are also available.

Double dark slides are used in the camera, space in the bottom of which is provided for carrying two not placed in situ, but a focussing screen is also fitted for stand work. The rising front, which is available for either horizontal or vertical pictures, moves to the very great extent of one and a half inches, a long rise on a 5 × 4 plate.



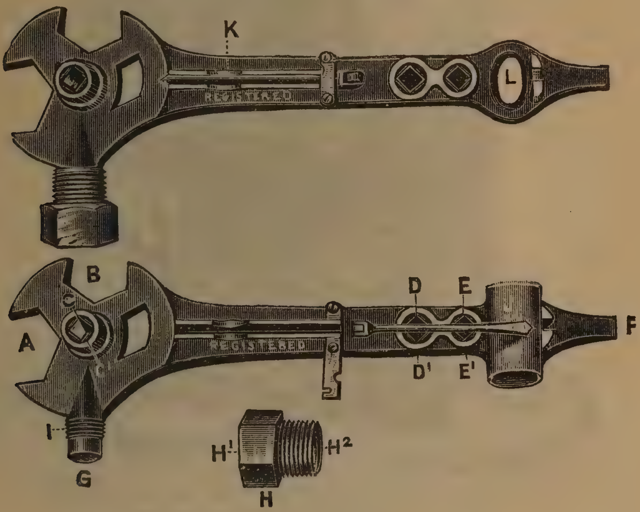
"THE B.P. COMBINATION KEY."

Manufactured and sold by the Scotch and Irish Oxygen Co., Polmadie, Glasgow.

The "B. P. Combination Key" is in stamped steel, case hardened throughout; the reversible union or coupling H is made in gun-metal.

A To suit Manchester Oxygen Co.'s and other gland nuts.
B To suit Brin's, Birmingham, and Scotch and Irish Oxygen Company's and other gland nuts, also to take reversible union H.
C To suit Manchester, Birmingham, and Scotch and Irish Oxygen Company's, &c., spindles 5-16 in. square.
C^1 To suit Brin's Oxygen Co.'s, &c., spindles 9-32 in. square, also the advantage of taking 5-16 in. spindle when it becomes slightly worn and rounded on the corners.
D½ To suit ¼ in. full spindles employed by some gas compressing companies for oxygen and nitrous oxide for dentists, &c.

D^1 To suit ¼ in. bare spindles employed by some gas compressing companies for oxygen and nitrous oxides for dentists, &c.
E To suit odd or bastard size spindles.
E^1 To suit odd or bastard size spindles.
It will be noticed that six different size spindles are provided for.
F Screwdriver.
G Hammer-head.
H Gun-metal reversible union to suit gauge, regulator, or slow valve; the end H^1 is screwed to fit Scotch and Irish Oxygen Co.'s or other externally screwed oxygen valves, and H^2 fits the bull-nose or internally screwed oxygen valves of Brin's, Birmingham, and Manchester Oxygen Co.'s, and others.



I It will be noticed is screwed ($\frac{3}{8}$ in. gas thread—same as tails of gauges, regulators, slow valves, &c., &c.), to carry the reversible union H.
J Lime tongs.
K Lime cleaner; the pin is stiffly hinged and brought to right angles with the lever of key when used to clean out the hole in lime.
L Wing nut, &c., lever.

THE NEW FOLDING FRENAS.

Manufactured and sold by R. & J. Beck, 68, Cornhill, E.C.

The new Folding Frena Cameras, Nos. 7 and 8, which Messrs. Beck have recently introduced, are on the same model as the No. 6 Frena, which was also placed upon the market this year; but, whereas that camera is fitted with a fixed-focus lens, the new models are fitted with focussing arrangements and other adjustments. Either Frena films or glass plates can be used with these cameras, but the No. 8 Folding Frena is so arranged that its special adjustments need not be used unless preferred.

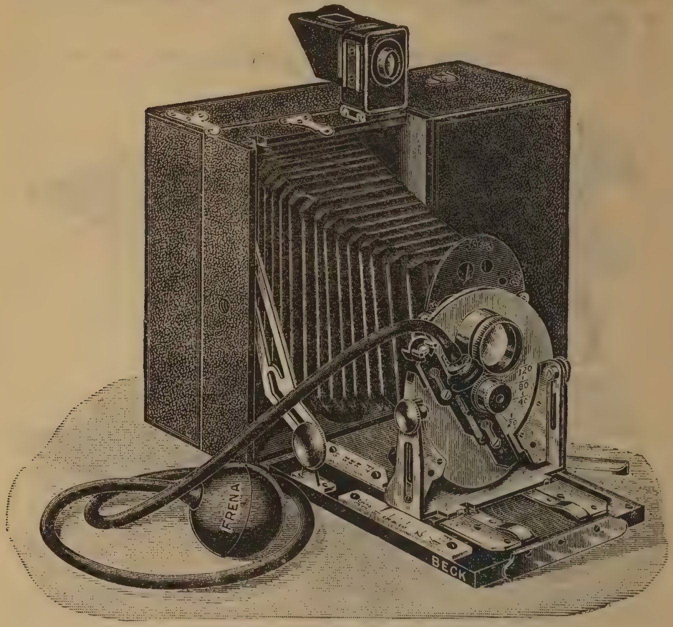


FIG. 1.—The Nos. 7 & 8 Folding Frena (open).

The Film-holder contains a sliding box, holding any number of Frena films from one to forty under spring pressure, the front one always being in the focus of the lens. To change the film, this sliding box is partially withdrawn while the camera is held with its lens end pointing downwards. By turning the handle the foremost film is automatically dropped into the receiving chamber, where the exposed films are deposited in a pack one by one, in the order in which they have been taken. By means of a new arrangement of the film-holder, the Folding Frena is constructed so that the lens, shutter, and camera can be detached from the magazine and film-changing portion. With the addition of a ground-glass attachment and double plate-holder, it can be used as an ordinary plate camera.

For focussing the camera a lever adjustment is provided and a scale of feet for setting the lens, which is especially adjusted in each camera so that entire reliance may be placed on its accuracy. Besides this an arrangement has been attached, so that the camera may be focussed by the direct method, even while the film-holder is attached to the camera. If the slide of the film-changing portion be drawn out as shown in fig. 4, a focussing glass, B, which is supplied with each camera, may be inserted in a spring trap-door, A. This focussing glass has a ground glass at one

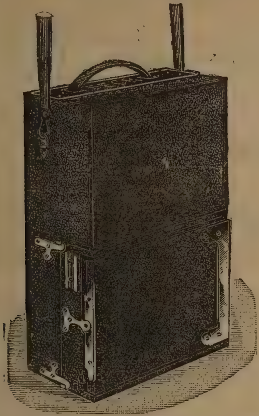


FIG. 2.—The No. 8 Folding Frena (closed).

end, which, when inserted, is in the exact position that the film usually occupies, and by looking through the magnifying lens at the other end the centre of the picture may be focussed direct.

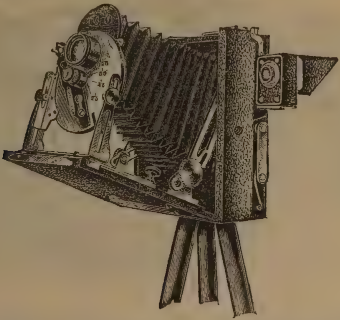


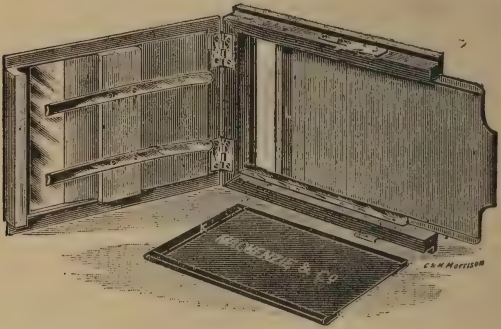
FIG. 3.—Nos. 7 & 8 Folding Frena, showing Camera as used for Glass Plates. Swing Back and Rising Front are shown in use.

A swing back is provided. The side links which support the tailboard are so made that the tailboard snaps under ordinary circumstances into the horizontal position, but for use of the swing back it may be clamped by means of two milled heads at any angle required. Fig. 3 shows the camera with swing back and rising front in use. The finder, which is shown in figs. 1 and 3, is a brilliant finder made on the principle of the Cornex finder, which, whilst giving a brilliant picture, shows at the same time a perfectly stationary image. It packs away into the camera when not in use, but, when attached to it, can be used for either horizontal or vertical pictures by merely revolving the back portion without shifting its position on the camera. The No. 8 Folding Frena carries one of the new Beck-Steinheil orthostigmat lenses, with an aperture of *f*-6.3, at which the margins of the plate are as sharp as the centre, and the rising front can be used to its full extent, namely, one inch. The front half of the lens may be removed, and the back half used alone as a lens of double the focus and one quarter the speed. For use with this back lens only, the tailboard of the camera can be pulled out, thus making a double extension.

THE MACKENZIE-WISHART DAYLIGHT SLIDE AND ENVELOPES.

Manufactured and sold by Mackenzie & Co., 17, Douglas-street, Glasgow.

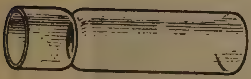
The following description, supplied by Messrs. Mackenzie, so accurately represents the details of their daylight slide and envelopes, that we quote it as supplied. We have several times examined and tested this method of daylight changing, and have found it infallible:—"The envelope consists of two parts, the inner being composed of light-proof cloth, and the outer of black celluloid. The plate is inserted between the grooves of the inner part, and covered with the flap, and, at the uncovered end of the plate, is inserted in the open end of the outer part. The slide is made of book form, one side being fitted with a sliding shutter. The envelope containing the plate is laid within the slide on the shutter, which has a groove near its end to engage with a bar on the covering flap of the envelope. The other side of the slide is fitted with a spring to keep the plate in position, and has an opening covered with celluloid, by which any number or mark on the envelope may be read. It also shows if the envelope flap works properly when the shutter is drawn and closed. When the slide is placed in the camera and the shutter drawn, its groove, engaging with the bar on the envelope flap, draws it and the flap off the plate and rolls it up within the slide, and on the closing of the shutter recovers the plate. The envelope and its plate can then be taken out of the slide and placed in the pocket."



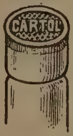
THE "CARTOL" SYSTEM.

John J. Griffin & Sons, Limited, 20-26, Sardinia-street, Lincoln's Inn-fields, W.C.

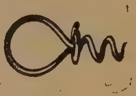
The "Cartol" system of packing accurately weighed quantities of uncompressed developing powders is thus described in a little pamphlet issued by Messrs. Griffin:—"A glass tube is divided off into two compartments. The smaller sections contains the oxidiser, the larger section the accelerator. The divider prevents decomposition between the two. A wafer of cork closes both ends, which are then hermetically sealed and stamped. With each box of cartols a special corkscrew is supplied, and by its use the tubes may be opened without difficulty." Pyro, hydroquinone, amidol, kachin, ortol, metol, and other "cartols" are issued.



Plain Cartol Tube.



End of Cartol showing Sealing and Stamping.



Tool for Removing Cork.

Stock Bottles—Old Method.

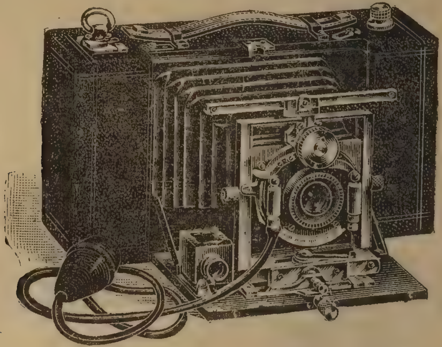
Cartol—New Method.

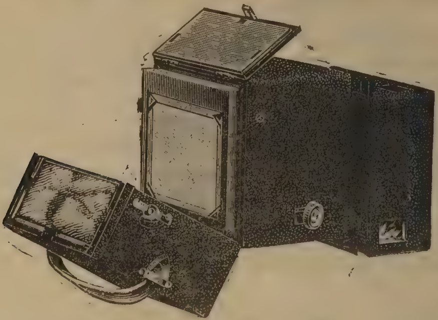
THE "TRIBEES" CAMERAS.

Manufactured and sold by the Busch Camera Company, 33, Hatton Garden, E.C.

A set of the "Tribees" (or Busch) Cameras has been placed before us for examination. The first is the "Cycam," a cartridge film camera, which is constructed to take daylight loading films. The body of this camera is made of mahogany, covered with leather, and mounted with nickelled brass fittings outside. The internal parts are of polished brass and mahogany. The baseboard falls down, and the front is pulled forward and locked into position ready for instant use. The camera for taking 5 by 4 pictures measures, when closed, 8½ by 4¾ by 2¾, and weighs 40 ounces. It is fitted with the "Unicum" shutter, having pneumatic and finger release, and giving time and one to one-hundredth part of a second exposures. The other features of the camera are a Busch lens of 6½ in. focus working at *f*6.5; rising, falling, and sliding front; hinged view finder, adjustable for horizontal or vertical pictures; and an iconometer, by means of which an exact view of the picture to appear on the plate can be obtained.

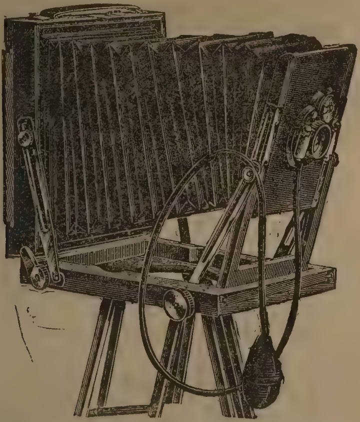
"The Meda" Combination Hand and Stand Camera. As a hand camera ready for use, this instrument measures $7\frac{3}{4}$ by $5\frac{1}{2}$ by $5\frac{1}{2}$, and weighs 49 ounces. Its great feature is that by one simple movement it is converted into a stand camera, the glass screen comes forward into position, and the camera is ready for focussing. It carries 12 plates in metal sheaths in a removable changing-box. The act of opening the camera closes the plate chamber, and brings the focussing screen into position automatically. The act of closing the camera removes the screen and leaves the plate ready for exposure. The changing of plates is by the bag system. The box containing them is removable, and extra boxes can be had, and the camera loaded in daylight. Two other finders are an adjustable objective and scale corresponding with the scale on the rising part of the camera, so that, when used as an ordinary hand camera without screen, one can adjust the rise or fall of the camera front and secure the same view on the plate as appears in the finder. Focussing is done by means of a thumb-screw which racks out the front part of the camera holding the lens and shutter. A scale is attached showing the distance at which objects are in focus. The camera is fitted with the Busch lens of five inches focus f-6 and "Unicum" shutter, with





time and instantaneous movement one to one-hundredth second. Its body is of solid mahogany, clamped and covered with grained leather.

"The Tribees" Magazine Camera, for glass plates.—This is made of mahogany, covered with black leather. It has a capacity for 12 plates, which is changed by a method whereby it is impossible for more than one to drop at a time. Focussing is accomplished by means of a bellows rack worked by a thumb-screw outside, and is so arranged that exact adjustment of the lens to the scale is secured. The scale is read on the side of the camera, and engraved for distance of five feet to infinity. The lens is the Busch detective aplanat of 5 inch focus working at *f*-6, and is mounted on the "Unicum" shutter. There are two finders which require no shading, but give brilliant views in the strongest sunlight. Horizontal or vertical pictures can be obtained, and bushes and screws are provided for use on stand.



"The Tribees" Field Camera.—In this camera the front is made to fall down into position on the baseboard, and the lens and shutter fit into the aperture resulting from the turntable, so that when closed in this manner the whole is contained in an exceedingly compact form. The back is made to slide forward on brass grooves for use with wide angle short focus lenses. The front can also be swung forward or back, and an extreme rise and fall of the front is obtained. The turntable fits direct on to the legs of the stand, which is of oak, three-fold sliding and folding legs. A Busch rapid aplanat lens is fitted to the "Unicum" shutter.

"BICHROME" LAMPS.

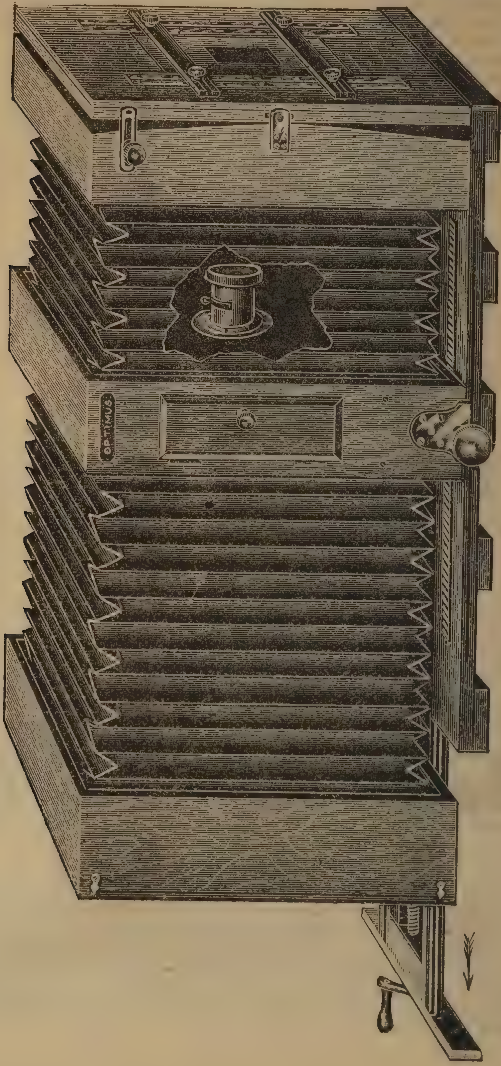
W. Watson & Sons, 313, High Holborn, W.C.

The use of a solution of bichromate of potash as an "illuminating medium" for dark-room purposes has given Messrs. Watson the opportunity of providing two lamps, to which a tank of the mixture may be applied as the "light filter," if we may use the term in this connection. The system adopted is that of a lamp of the ordinary construction, and an incandescent electric bulb, both of which have been adapted to take the coloured solution.

NEW "OPTIMUS" CAMERAS.

Manufactured and sold by Perken, Son, & Co., Limited, Hatton Garden, London, E.C.

THE appended descriptive details relate to the newest series of hand,

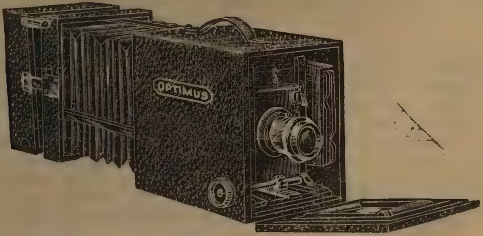


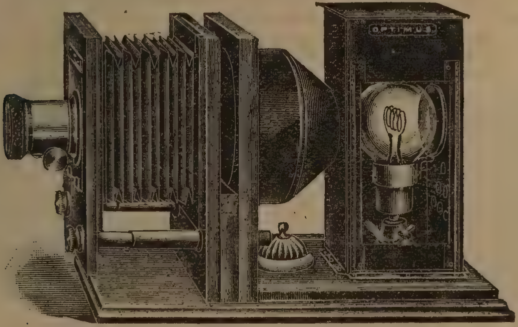
stand, and enlarging cameras which are made by Messrs. Perken, Son, and Co., Limited:

The "Optimus" Direct Enlarging and Reducing Camera is arranged somewhat like the ordinary long extension instrument; but with the difference that the baseboard is rigid, and the front of the camera carries the negative to be enlarged. This is held in position by a contrivance enabling the whole or any portion of negatives of varying sizes to be enlarged, and has movements to correct vertical faults. The central frame carries the lens, the mechanical focussing is by rack and pinion, and the exposure is given by uncapping the lens by means of a sliding panel passing at the back of the lens. In the larger sizes a door is provided for altering the lens apertures. In the smaller sizes this is unnecessary, as the lens-board can be reached easily from the back. The extension baseboard is actuated by endless-screw adjustment, and the dark slide in which the bromide paper is placed is inserted in the camera in the usual way.

UBIQUE No. 3 MODEL.

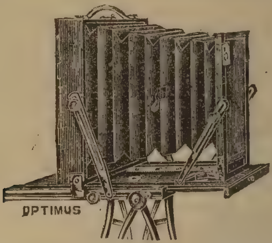
The No. 3 Ubique Camera is arranged for long extension work, so that lenses of varying foci can be used. The instrument is fitted with swing back in either the horizontal or vertical direction, and has rising and falling front. The three double dark slides are carried inside the camera. The finder of the brilliant concave type does not form a loose part, but is hinged to the apparatus, and disappears from sight when





not in use. The shutter is of roller-blind form, of varying speeds, and gives time and instantaneous exposures, having speed indicator, and, if desired, can be released by pneumatic ball, instead of the usual press knob.

The enlarger is of the well-known cantilever form, and is constructed to work with electric light, one of the new 100 or 200 c.p. incandescent focus electric lamps being employed. A switch is supplied, so that the exposure can be made independently of the lens cap. Existing cantilever enlargers can be fitted with the electric installation without alteration.

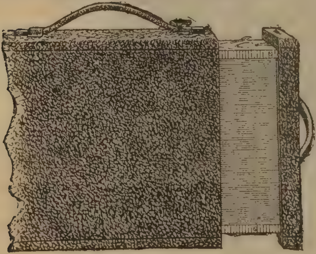


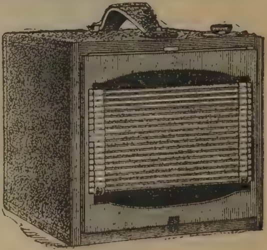
This camera, formerly called the Rayment Patent, has recently been greatly improved. The attachment of the camera front to the extending baseboard has been constructed in such a way that the operation is much simplified, and perfect rigidity attained, the amount of rise and fall to the lens-board being at the same time greatly increased. These advantages have been secured by a neat contrivance of two spring catches, one on either side of the telescopic baseboard, and forming part of the metal rackwork of the instrument. The camera has every movement of utility, and is extremely light without any sacrifice of strength.

THE "BULLARD" FOLDING MAGAZINE HAND CAMERAS.

Wholesale Agents: A. E. Staley & Co., 35, Aldermanbury, E.C.

The special feature of the Bullard camera which calls for notice is the changing system. In the first illustration the camera is shown with the magazine section extended. To grasp the handle on the rear end of the magazine, and to pull out and push back this section, is all that is required. The action is smooth and easy, and the changing plate carriers in rotating within the magazine offer no apparent resistance. A





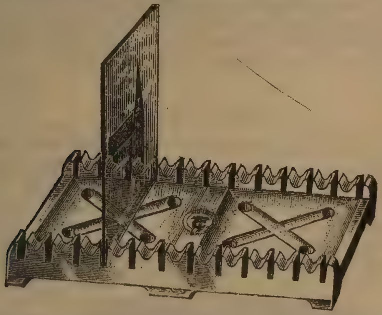
feature of the magazine is its fixed mechanism, the only movable parts being the counter and sliding case. The plate carriers do the moving, and their course is controlled by grooves or ways on the inside of the magazine chamber, in which the projections or trunnions on the four corners of the carriers travel.

This changing system, one of the simplest and most effective we have tried, may be likened to the action of one side of a concertina—the body of the camera is pulled out and pushed home, a motion which suffices to remove the exposed plate (in a sheath) from the focal plane, direct it to the rear, and place another plate in position. We worked the system many times, and were much struck by its simplicity and certainty. The Bullard should be one of the most successful magazine cameras of the 1901 season.

A PORCELAIN DRAINER.

Manufactured by Taylor, Tunnicliff, & Co , Eastwood, Hanley, Staffordshire.

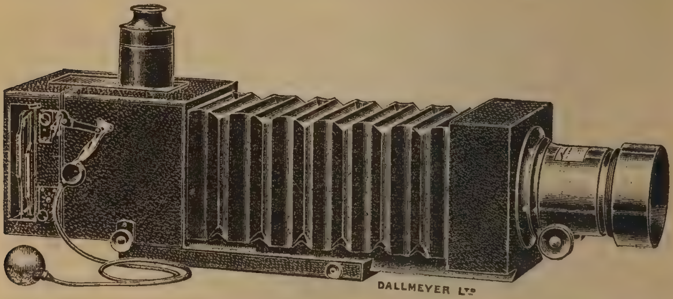
This neat and beautifully made porcelain drainer will be found of the greatest service on the dark room bench or in the sink. It holds a dozen plates, as the illustration shows, and in case of need it may be utilised as a washer by standing it in a suitable vessel under a tap. Two sizes are made, the one holding negatives up to ½-plate, the other up to 8½ × 6½, at prices of 9d. and 1s. respectively. We have used one of these drainers with the greatest satisfaction. The plates are securely held, and the drainer is so constructed that it has a firm base. It is obviously as useful for lantern slides as for negatives.



THE NEW NATURALISTS' HAND CAMERA.

J. H. Dallmeyer, Limited, 25, Newman-street, W.

Messrs. Dallmeyer have just introduced an improved model of their Naturalists' (or Telephoto) Hand Camera, which should prove a valuable tool for those whose work it is to photograph birds, animals, and the like, or to obtain studies or details from distant positions, with the same ease that they can be obtained at close quarters with an ordinary hand camera. It is well known that focussing by scale is out of the question with a high power telephoto lens, as errors of even a foot or two in judging distance prove disastrous when the plate comes to be developed. We have in this camera a remarkably neat reflex arrangement, consisting of a surface silvered mirror suitably placed so as to reflect the image upon the field lens of a specially constructed eyepiece one of the surfaces of which is finely ground, thereby avoiding the error sometimes made in focussing an aerial image. The telephoto lens may be removed, and any ordinary lens of 6 in. focal length or longer

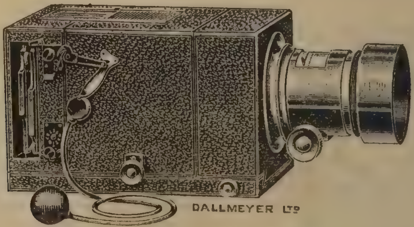


may be substituted, still, of course, retaining the mirror focussing. The finder field is 2 inches in diameter, thus giving a clear view of the most important portion of the ¼-plate the apparatus is designed to take. We have not previously seen any camera of the reflex type in which such exact focussing could be obtained with such ease.

THE "ADON."

J. H. Dallmeyer, Limited, 25, Newman-street, W.

The Adon is the registered name of the new telephoto lens which Messrs. J. H. Dallmeyer, Ltd., are preparing for next spring. It promises to be a valuable adjunct to the hand camera, as it fits in front of the ordinary lens, and enables enlarged images to be obtained in cases where the lens is not readily removable from the camera. A magnification of nearly three diameters can be obtained with the ordinary working distance of

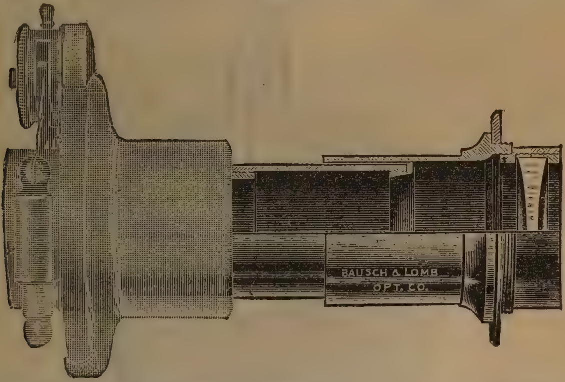


the lens without any appreciable loss of intensity. If the ordinary lens be used, and the "Adon" screwed into its flange, it forms a complete telephoto lens of higher power, and consequently lower intensity. We shall watch with great interest for the advent of this instrument, and hope early in the year to give the readers of the Journal some of our own experiences with it.

THE BAUSCH AND LOMB HAND CAMERA TELEPHOTO LENS.

London Agents: A. E. Staley & Co., 35, Aldermanbury, E.C.

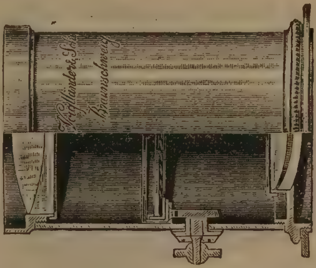
The negative attachment for telephoto work which has been introduced by Messrs. Bausch and Lomb is applied to the camera by removing the ordinary lens, screwing the attachment in its place, and then attaching the positive lens to the front of the telephoto lens. To give an illustration of the degree of magnification obtainable in an ordinary hand camera, working with a positive lens of 6 in. focus (approx.), with the negative attachment in position, the length of draw or bellows would require to be 8¼ inches in order that the magnification of 2½ diameters could be obtained.



THE VOIGTLANDER F-2.3 PORTRAIT LENS.

Manufactured and sold by Voigtlander & Son, 92, Hatton-garden, E.C.

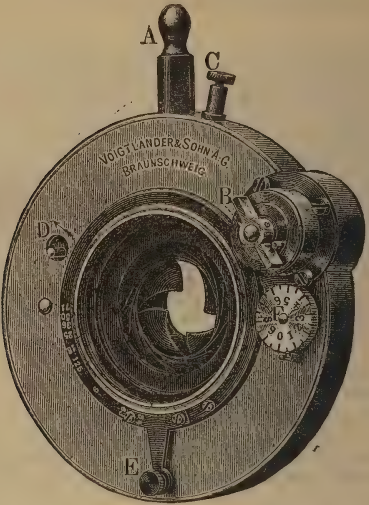
This lens has been specially designed for astro-photography, negatives of nebulæ, star spectra, cinematographic negative and projection work, and studio portraiture.



THE VOIGTLANDER SECTOR SHUTTER.

Manufactured and sold by Voigtlander & Son, 92, Hatton-garden, E.C.

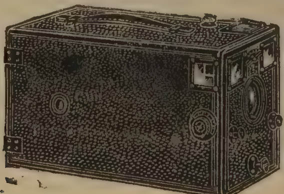
The leaves or "iris" of this shutter commence to open in the axis of the objective. When slightly further open, the edges of the lens are also illuminated. The lens, therefore, according to Messrs. Voigtlander's theory, works with or without the shutter under the same optical conditions. The shutter is made of metal, brass and aluminium. It is adjustable for exposures from five seconds to 1-200th of a second.



THE FAIRFIELD HAND CAMERA.

T. T. Hora, 346, York-road, Wandsworth, S.W.

This camera is covered in morocco leather, and takes twelve ¼-plates in sheaths. It is fitted with a Rapid Rectilinear lens, having iris dia-



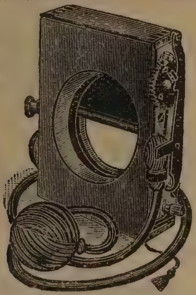
phragms and an engraved scale for focussing. The shutter working behind the lens gives variable speeds and time exposure. Two improved brilliant view finders, placing the view the correct way up, and a plate indicator are affixed to the camera.

The regular features of the instrument are a special achromatic lens, pneumatic shutter with bulb and hose arranged for time bulb and instantaneous exposures and changes of speed, rising front, reversible finder, two-point descriptive fixed focus scale, regular focussing scale for adjustable focus and twelve plate carriers. The magazine has a capacity of eighteen 4×5 glass plates.

THE "FAIRFIELD" SHUTTER.

T. T. Hora, 343, York-road, Wandsworth, S.W.

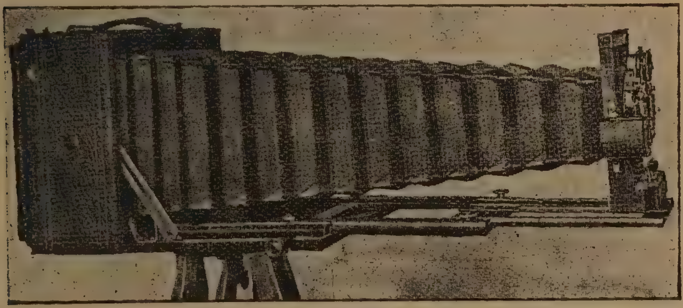
These shutters are made on the roller blind principle. The bodies are of mahogany. The moving parts are of metal working in brass plates running down the whole length of each side of the shutter. Each shutter is fitted with speed indicator, so that exposures of 1-15 to 1-90 of a second can be given.



THE LONG-FOCUS CYCLE WIZARD CAMERA.

English Agents: Seabrook Bros. Co., 21, Edmund-place, London, E.C.

During the forthcoming season the Manhattan Optical Company (through their agents, Messrs. Seabrook Bros. and Co.) propose introducing several

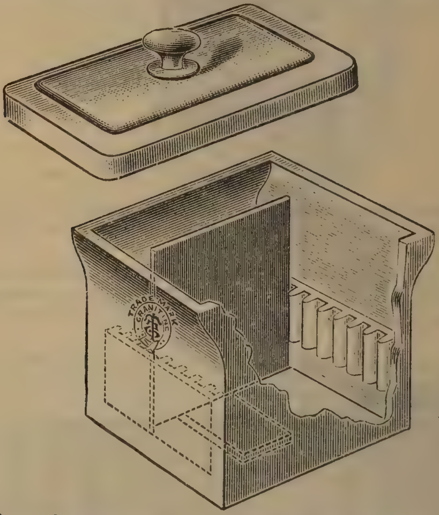


new patterns of the Wizard Cameras, some of which have been submitted to us for our inspection. Of these we select for reference the long-focus cycle Wizard, shown in the illustration. Its salient features are as follows:—The 5×4 camera admits of the use of a lens having a focal length of 16 inches, and it is fitted with a Manhattan Rapid Rectilinear lens, allowing of three foci—$6\frac{1}{2}$, $11\frac{1}{2}$, and 16 inches. The brass parts of the instrument are nickel plated, and the bellows is of real Russian leather. The body is of mahogany and cherry, hand polished. Rapidity is secured by the provision of two lock nuts for each extensible section. There are rising, falling, and sliding fronts, and a reversible back. A roll-holder can be fitted to the camera, which has also a level, a view finder, and the Wizard shutter. Long-focus work will be always popular with the tourist photographer, to whom the type of instrument under notice should appeal. The Wizard cameras are excellent examples of American mechanical ingenuity applied to the needs of photography.

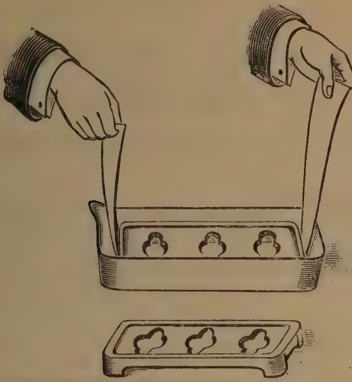
A PORCELAIN BATH FOR STAND DEVELOPMENT.

Manufactured and sold by Taylor, Tunnicliff, & Co., Eastwood, Hanley, Staffs.

THIS conveniently designed trough—one of the firm's well-known granitine series—is made deep enough to allow of the solution covering the plate. In the upper part sufficient space has been left for the insertion of the fingers when it is desired to remove the negatives for examination. The cover for the trough will be much appreciated by those resorting to protracted or "stand" development. It is hardly necessary to say that this trough is very neatly produced. Like all Messrs. Taylor's "granitine" work, it is a pleasure to handle in the dark room. The stand development trough is at present made only in $\frac{1}{4}$-plate, but a demand will lead to the introduction of other sizes.



Messrs. Taylor, Tunnicliff and Co. have also introduced a porcelain perforated weight for developing films in lengths. The weight is placed in the developer with the film passed under it face downwards, and by drawing it backwards and forwards under the weight is gradually developed in any length that can be held by the two ends. Being made of highly-glazed porcelain, the film can be safely passed underneath the weight, film side upwards, without being damaged.



PRACTICAL NOTES AND SUGGESTIONS OF THE YEAR.

(*Compiled from Various Sources by* The Editor.)

Balagny's Silver Intensifier.

This was given in the "Bulletin de la Societe Francaise":—

1.

Sodium sulphide	25 parts.
Water	100 parts.

2.

Silver nitrate	5 parts.
Water	100 parts.

No. 1 is dropped slowly into No. 2. The precipitate first formed is redissolved on further addition of No. 1. The negative is placed in this till bleached, and well washed and redeveloped with any developer.

Blue Prints, Improvement of.

In an article upon this subject, which appeared in the "Photographisches Wochenblatt," N. Grun recommended the use of peroxide of hydrogen for giving greater intensity of colour. A blue print, when it leaves the washing water, is much less intense than after it has been dried and exposed to air for twenty-four hours. This change, doubtless due to oxidation, may be accelerated by adding a few drops of peroxide of hydrogen to the washing water. It also has the advantage of not imparting a blue tinge to the whites, which usually follows the use of ferric salts and hydrochloric acid. Those who have to produce blue prints quickly should find the use of peroxide of hydrogen of some value, as the colour is of full intensity as soon as the print is dry. It will also be found useful when the sensitised paper is rather old and gives veiled prints. Sensitised paper that has turned greenish-blue should be considerably overexposed until a decided image is visible. A little washing soda solution should be added to the washing water, but very sparing use should be made of it. Repeat the washing, if necessary, until the whites are clear. Give the prints a final wash in water, to which a small quantity of peroxide of hydrogen has been added, which will intensify them.

Carbon Printing on Celluloid.

Dr. D'Arcy Power, of San Francisco, communicated to The British Journal of Photography the following description of some experiments in carbon printing with celluloid as a support:—

"More than a year ago I experimented on the printing of carbon tissue through a film of transparent celluloid, and found that no perceptible difference of definition resulted from its interposition; on the contrary, that the image was rather benefited than otherwise by its use. In these experiments the carbon tissue was squeegeed direct from the sensitising bath on to the celluloid, the outer surface washed clean, and, when dry, the tissue printed through the celluloid, and, after development in the usual way, the celluloid was backed up by squeegeeing it in optical contact with paper, or by coating it with a layer of paint. In this way I obtained very beautiful prints, having a highly polished surface, that elicited much praise from those who love that kind of thing, but which on that account did not please me. Some time elapsed before it occurred to me that celluloid with a ground-glass surface could be printed through, but one day I tried the experiment, and I was not a little astonished to find that the image developed nearly as sharp as with unground celluloid. This solved the whole difficulty of direct printing. I coated a sheet of ground-glass celluloid with the usual gelatine and pigment coating mixture. To sensitise it it was only necessary to immerse it in the bichromate solution and hang it up to dry. Printing was done as with silver paper, no safe-edge being required. Development can be proceeded with immediately, the safe-edge being unnecessary, and the moistening and pressure not needed. Direct from the printing frame it passes into the hot water, is washed up, dried, and backed. The backing may consist of paper of any desired tint or grain, squeegeed into optical contact with the print by means of a solution of gelatine, or it may be paint ground in varnish, such as may be bought anywhere. By judicious backing, prints of exceeding beauty may be obtained. The ground celluloid at present on the market gives a surface slightly more matt than is desirable for small subjects with fine details. This, however, may be easily reduced to any extent desired by rubbing the matt surface with a mixture of one part of ether in eight parts of alcohol. Let me here sum up the advantages of my method of working:—

First. Tissue, after sensitising, dries flat and smooth.

Second. Requires no safe-edge.

Third. No transfer and subsequent waiting prior to development.

Fourth. No second transfer to obtain correct position.

Fifth. A surface that can be readily spotted, retouched, offensive high lights toned down, or painted out, or the whole pictures tinted as a crystoleum.

Sixth. After the picture is produced, the power of choosing the tint and apparent texture of the surface it shall seem to possess.

Seventh. A surface that is indestructible and may be washed, thus allowing of framing without glass, whereby the purity of tint of the print is spared the modifying effect of colour in the glass.

Against these many advantages the only added inconvenience is the trouble of coating the celluloid.

Until celluloid coated with pigment can be bought, the worker desirous of using this process may choose one of three courses.

First. He may coat the celluloid himself, which is a little troublesome, as it is more difficult to handle than paper.

Second. He may sensitise ordinary carbon tissue and squeegee it to the smooth side of the frosted celluloid. If he follow this method, he will need to take care that no air bubbles, even the smallest, interpose between the tissue and the celluloid, and he will also need to be careful that as the tissue dries it does not separate from the celluloid surface before printing, or loss of definition over the detached portion will result.

Third. Tissue may be sensitised and printed in the ordinary way, transferred to celluloid, and then backed up. This last method, while the same in all respects as single transfer, gives the correct position without a double transfer. It permits of choice of backing, and has the advantage of absolute sharpness of definition. Until coated celluloid is placed upon the market it will hold the first place with the general worker, and is the method I at present employ.

I have not found that any coating of the celluloid with chromatised gelatine is necessary, but some care is required in squeegeeing to the final support, that no air bubbles intervene. They will cause stars on the print. Spotting and retouching is best done with oil colours, and the power of modification is almost unlimited."

Combined Toning Bath.

According to a short note in the "Photographische Mittheilungen," the condition of the combined toning and fixing bath prepared with sulphocyanide of ammonium, without lead, may be considerably improved and approximated to an old bath, by first washing the prints in a small quantity of water, to be added to the toning bath. Dr. E. Hegg, who recommends this, states that the first prints toned in such a bath, instead of being of disagreeable yellowish-brown tone, as is usually the case with a freshly prepared bath, are of a warm brown or violet colour, according to the length of immersion. It is, of course, necessary to avoid diluting the bath, by making it of sufficient strength in the first instance, so that the quantity of water in which the prints are washed shall not reduce it below the normal. To obtain good results with certainty, Dr. Hegg recommends that there should be twenty c. c. of solution to each print 13 × 18 cm., and that the water in which one quarter to one third of the prints have been washed be added to the bath.

Combined Toning and Fixing Bath.

In speaking upon this subject at the Berlin Photographic Society, Dr. E. Vogel stated that it was not advisable to use the combined bath for commercial photographs, notwithstanding its convenience and the fine tones it produced. It was capable of giving durable prints when in good condition, and he had found that the pictures faded less rapidly when a fresh bath was used. There was no definite explanation of the causes of fading with this process, but the atmosphere, without doubt, was a factor. It was an extraordinary fact that there was no fading where marks upon collodio-chloride paper were due to perspiration from the fingers. Professor Raschdorff stated that he had noticed that the combined bath would keep good in summer, but not in winter. He used a mixture of old and fresh solutions, which gave him satisfactory results. Herr P. Hanneke said that, as a test, he had mounted a collodio-chloride print, toned in the combined bath, and poured a solution of hypo-sulphite of soda upon it, and allowed it to remain in that condition for several hours. The print was then slightly rinsed, and, after a lapse of two years, had not shown the slightest trace of fading.

Comparison of Developers in Ordinary use.

The following tables, translated from the "Photographische Mittheilungen," show the comparison of the developing solutions in general use and their comparative cost:—

A.—SODA DEVELOPERS.

Per Litre of Water.	Developer.	Crystallised Sulphite of Soda.	Metabisulphite of potash.	Soda.	Comparative cost, hydroquinone being = 1.
	Grammes.	Grammes.	Grammes.	Grammes.	
Hydroquinone	5·0	33	—	50	1·0
Pyrogallol	9·3	66	—	33	2·1
Eikonogen	12·5	50	—	38	3·1
Metol	5·0	50	—	50	3·3
Ortol	7·5	90	4	60	4·8

B.—POTASH DEVELOPERS.

Per Litre of Water.	Developer.	Crystallised sulphite of soda.	Metabisulphite of potash.	Carbonate of potash	Comparative cost, hydroquinone being = 1.
	Grammes.	Grammes.	Grammes.	Grammes.	
Hydroquinone	5·0	30	—	50	1·0
Pyrogallol	2·8	64	—	13	0.8
Pyrocatechin	10·0	40	—	50	3·0
Eikonogen (E. Vogel)...........	12·5	50	—	40	2·5
,, (maker's formula)	30·0	120	—	50	5·6
Para-amidophenol	6·7	40	—	40	3·4
Metol	7·5	75	—	25	3·8
Glycin	8·0	40	—	40	3·9
Ortol	7·5	90	4	30	3·9

The comparative cost, as given in these tables, should not be taken as representing the absolute cost in practical use, the relative density and stability in use being important factors, which must also be taken into consideration. It is well known that hydroquinone, which we have taken as the unit, gives great density, and oxidises slowly; but, on the other hand, when freshly prepared, it is more prone to veil than some other solutions, such as pyrocatechin and glycin, and it loses energy at low temperatures (under 14° C.). The old ferrous-oxalate developer is about twice as expensive as the hydroquinone developer mentioned above.

The potash developers are more rapid in action than the soda developers, and may therefore be used with more water for many kinds of work.

Coppering a Negative.

The following process, which was described by Graf Vittorio Turati, of Milan, in Liesegang's "Photographisches Almanach," might be useful for the preparation of small ornaments by means of photography. The negative or positive should be prepared by means of the wet-collodion process, and fixed and washed as usual, only preferably on plate glass. The negative should be placed in a clean dish, and covered with the ordinary cupric bromide intensifying solution, and then blackened with silver nitrate, and this should be repeated two or three times, and after washing the negative may be dried by heat or spontaneously. It should now be placed in an accurately levelled dish, and covered to the depth of about one millimetre with a saturated solution of cupric sulphate, and allowed to remain for about five minutes. Then should be added about half the quantity of fresh cupric sulphate solution which has been acidulated with sulphuric acid, and the dish well rocked. Fine iron filings should now be carefully and evenly sifted over the whole of the negative, when the negative image will be seen to gradually cover itself with a fine deposit of red copper, and it is then only necessary to rinse it under a tap and allow it to dry.

Dehydration of Photographic Chemicals.

Most of the salts used in photography can be converted into the anhydrous or dry form by heat. The temperatures at which these take place are as follows for a few of the most-used substances:—

Salt.	Temp. (°C.)	Remarks.
Sodium thiosulphate	215	Begins to decompose at 220°.
Sodium sulphite	150	
Potassium carbonate	130	
Sodium alum	40-50	
Copper sulphate	220-260	Loses 4 of its 5 molecules of water at 100° C.
Sodium phosphate	100	

In most of the cases given above the temperature must be kept within a degree or two of that given. If it fall below, dehydration will not be complete; if it rise much above, other decompositions will set in.

On the semi-large scale the salts are rendered anhydrous by exposure in an oven heated to the temperature required, which must be indicated by a thermometer. An apparatus for a similar purpose, which may serve as an idea for some of our readers, was described by G. P. Drossbach in the "Berichte" of the Berlin Chemical Society not long ago. It consists of a wide tube, which is heated by a furnace. It is provided at one end with a hopper, for the introduction of the powdered substance, and contains the Archimedean spiral, the axle of which runs loosely in the constricted end of the tube and in a bearing at each end. As the material is worked forward by the spiral it is continually turned over, and, before it reaches the exit end of the tube, is thoroughly ignited. Any gas in which it is desired to conduct the ignition is led into the apparatus at the constricted end of the tube. The apparatus as thus described is intended for the ignition of materials, &c., but, by arranging insulating media, such as asbestos, between the source of heat and the tube, and by passing a brisk current of dry air through the apparatus, it could serve as a dehydrating chamber.

Desiccated Dry Plates.

In a communication to the Photographic Convention of the United Kingdom, Mr. E. Howard Farmer said:—It is well known that dry plates, as ordinarily used, retain a considerable percentage of water, mainly in molecular combination with the gelatine. I find that the presence of this water in the film at the time of exposure has a large influence on the image, all the chief characteristics, i.e., definition, detail, density, speed, time of development, &c., being affected. Moreover, very small differences in the quantity of this moisture materially affect the result, so that negatives vary with the atmospheric conditions, as to temperature and humidity, at the time of working.

The drier the film, the better the definition and the greater the power of rendering fine detail; in lesser degree, the greater the speed and facility of developing density.

This property of the film can be utilised by desiccating plates for work where definition, detail, brilliancy, or maximum speed are desired, and in exposing plates wet where softness of image or the destruction of small textures and details are sought for. Extra-rapid plates or orthochromatic plates, in which the former of these qualities are usually found lacking, gain them when thoroughly desiccated to an extent hitherto only found in wet collodion or other specially prepared films.

A perfectly flat-topped kettle containing boiling water is a convenient appliance for desiccating plates. They are simply laid on to the flat top of the kettle with a piece of bibulous paper between to equalise the heating, and kept there a few minutes at a temperature of 200° before being placed in the slides, or a thick copper slab with an asbestos cover can be used. Too great or too prolonged heating will crack the film or induce fog.

Desiccated plates have been (with increasing satisfaction) in daily use here at the Polytechnic for several months past, and are already widely adopted in the trade for scientific work.

Discoloured Platinum Prints.

The imperfect elimination of the iron salts from platinum prints causes the paper to turn yellow in the course of time, and Herr Gaedicke recommends a bath of 15 grammes of soda and 20 grammes of chloride of lime dissolved in 200 c. c. of water as a bleaching agent. By a curious mistake chloride of calcium was printed originally instead of chloride of lime, and, as Herr Gaedicke remarks, it would have saved some trouble if a handful of salt had been taken instead. Such a solution is quite useless for the purpose. A solution of soda and chloride of lime will precipitate carbonate of calcium, but the supernatant fluid is a powerful bleaching agent.

Drying Prints, the Influence of Temperature in.

The influence of heat upon the tone of a print is a well-known fact. Dr. R. A. Reiss, of Lausanne, has endeavoured to ascertain the cause, and gives the result of some experiments in the "Photographische Chronik." Strips of P.O.P., 6 cm. broad and 10 cm. long, were exposed for various lengths of time to light, toned and fixed in the same combined bath, washed and mounted upon card, and cut in half. One set was dried at the ordinary temperature of a sitting-room, and the other set near a gas oven. The latter were dry in one and a half to two minutes. Those dried by heat had a more glossy surface, and differed from the other set in tone. The difference varied with the thickness of the film, being greater with the more thickly coated papers. Kurz's collodio-chloride paper, which has a very thin film, showed only a slight difference, whilst the Parisian paper "le Collodion" (Trumpet brand), with a thicker film, exhibited a more marked deviation. Lumiere's gelatino-chloride paper, which also has a very thick film, showed a very decided difference in tone, the prints dried by heat being much redder and very glossy. In the first trial with Lumiere's paper the prints were toned to a brown-red, and in the second to a blue-violet, but the latter, under exposure to heat, also dried to a deep red, whilst the halves allowed to dry spontaneously retained their blue-violet tone. Other makes of paper also exhibited variations in tone according to the method of drying. The writer thinks the change is due to the presence of air and water in the film after washing. When the print is exposed to heat, the surface of the film melts and dries. The air and water below the surface cannot escape readily, and the film consequently swells. On the other hand, when the film dries spontaneously, the air and water are allowed to escape gradually through the surface of the print, and the film is finally thinner than when the print is dried by heat. The writer is continuing his experiments, and purposes verifying the results by measurement of the sections under the microscope.

Etched Labels.

Every photographer knows how difficult it is to keep paper labels on the dark-room bottles, or, if they keep on, to keep them clean. The following method of etching labels is simple and cleanly:—

Solution No. 1.

Sodium fluoride	36 parts.
Distilled water	500 parts.

Dissolve and add—

Potassium sulphate	7 parts.

Solution No. 2.

Zinc chloride	14 parts.
Distilled water	500 parts.

Dissolve and add—

Strong hydrochloric acid	65 parts.

For use, mix in equal parts, and add sufficient Indian ink, in powder or solution, to enable one to see the letters. This mixture rapidly etches glass or porcelain, so that it is advisable to use a small inkstand made out of solid paraffin, and also a quill pen.

Ferric Oxalate for the Platinum Process.

Herr Gaedicke worked out the following method of preparing this salt, and published it in the "Photographisches Wochenblatt." To prepare half a litre of ferric oxalate solution of the strength required for the platinum process, take 30 grammes of iron wire, polish it with glass paper to free it from dust, place it in a porcelain dish with 150 c. c. of nitric acid, and heat it over a spirit lamp. At a certain temperature there will be violent ebullition, and red fumes will be emitted in considerable quantity. Avoid their effects by placing the vessel out of doors. If all the iron is not dissolved, add more acid. A thick, dark brown liquid is thus obtained, with a small precipitate of carbon, which is of no importance. Pour the brown fluid into another vessel containing 150 c. c. of strongest ammonia (sp. gr. 0.91); stir up the dark brown paste with a glass rod, and, if necessary, add more ammonia until it smells strongly of the same. Be careful to avoid waste, otherwise the final solution will be too weak. Dilute the paste with a little water and pour it into a 5-litre bottle. Make up the quantity to 4 litres with water, cork the bottle and well shake it. After it has stood for five minutes, gently lower the bottle on to its side with the neck projecting beyond the edge of the table, and let it rest five minutes longer. The brown precipitate will sink below the level of the neck, and the cork should then be slowly withdrawn to allow the water to escape. This process of washing by decantation should be repeated four times, and the bottle should be allowed to stand half an hour after the final washing to permit the removal of as much water as possible. After draining the precipitate, add 100 grammes of oxalic acid in crystals (fresh). This and subsequent operations should be done by artificial light. Stir or shake until completely dissolved, but avoid heating the preparation, as it would then decompose. The yellowish-green fluid should be filtered to remove the carbon, and kept in absolute darkness. If there is less than half a litre, make it up to that quantity with water, but the yield is usually about 600 c. c. In the latter case there will be only 17 instead of 20 grammes of ferric oxalate per 100 c.c.

Ferrous-oxalate Developer, a Durable.

Dr. Hauberisser, of Munich, has been making a series of experiments as to the action of certain additions to the ferrous-oxalate developer, and finds that the following gives the most lasting developer:—

1	Neutral potassium oxalate	500 parts.
	Hot distilled water	1500 parts.
2	Ferrous sulphate	200 parts.
	Distilled water	600 parts.
	Sulphuric acid	*q. s.*
3	Rochelle salts	20 parts.
	Water	100 parts.
4	Potassium bromide	10 parts.
	Water	100 parts.

For use, add 5 parts of No. 2 to 1½ parts of No. 3, and boil, and, whilst hot, add to 17½ parts of No. 1. For stand development, the above should be diluted with from 100 to 200 parts of water.

Filter Papers.

The "Deutsche Photographen Zeitung" mentioned that, if filter papers are immersed in a bath of nitric acid (sp. gr. 1.42) for a short time, and then well washed with water, they remain porous, and will not tear when used for filtering warm solutions.

Hard Negatives.

The "Photographische Chronik" recommends that the plates should not be alumed, and that, after fixing and washing, they should be immersed in a weak solution of blue-green dye. This stain will be absorbed most in the shadows, where no reduction of silver has taken place. After drying, the negative will print with less contrast and give a better rendering of the lights and shadows.

Hydro-metol Developer, a One-solution.

Guilleminot strongly commends the following developer: Boil 900 parts of water, and whilst still hot dissolve in order the following ingredients, taking care that one is completely dissolved before the next is added:—

Sodium sulphite	150 parts.
Hydroquinone	5 parts.
Metol	5 parts.
Potassium carbonate	30 parts.

For use, 1 part of this solution is mixed with 3 parts of water.

Intensifier, a New.

Mangin suggests, in "Photographische Chronik," the following mixture of the usual mercuric intensifier:—

A.

Old hydroquinone developer	50 parts.
Ten per cent. solution of citric acid	10 parts.

B.

Potassium ferricyanide	1 part.
Distilled water	50 parts.

Solution B is added to A as soon as the latter has become clear, and the mixture is then well shaken and filtered and the negative immersed in it.

Lantern Slides, the Colouring of.

In the "Bulletino della Soc. Fot. Ital." Roster pointed out that in colouring slides the best results are obtained with aniline colours, and that it is important that the colours should not destroy one another, and he suggests the following as satisfactory. Blue: Indigo carmine. This is the best colour for the sky. Green: (a) Malachite green. This is very brilliant, and must be sparingly used, and it is difficult to spread it evenly on large surfaces, and it is not suitable for plants and foliage. (b) A mixture of tropælin O and indigo carmine is the best for foliage, and, according to the proportion of these two, a cold, a brilliant, or a yellowish green is obtained, and also the colour of dead leaves. Yellow: (a) Tropælin O for bright yellow, mixed with eosine it gives flesh tints. (b) Mixtures of tropælin O and orange for darker and golden yellow. (c) Orange alone. Red: (a) Eosine for a bright red. (b) Mixture of eosine and orange for brilliant fiery red. For brown: (a) Bismarck brown or vesuvin; the former is to be preferred for warm brown tones. (b) Mixtures of Bismarck brown and indigo carmine for cold brown tones.

The separate colours, as well as the mixtures, may be kept in stock in stoppered bottles. A retouching desk should be used with a sheet of white paper as a reflector, and the plate slightly tilted. The reflector should be about four inches from the plate.

The transparency should be allowed to thoroughly soften by soaking in water for half an hour, then blotted off with blotting-paper, and placed on the retouching desk. The colours should be applied with a camel's-hair brush in a very dilute state, and the operation repeated to obtain the necessary intensity. After every application the excess of colour should be removed with a sheet of blotting-paper. When colouring large surfaces, it is advisable to pass over it a broad brush dipped in plain water before blotting off: this evens the colour. In working up the sky the transparency should be turned upside down, and the colour applied from the landscape, a natural gradation will thus be obtained.

Mercuric Intensification.

In the "Photographische Mittheilungen" Dr. E. Vogel discussed the question: "How long should plates be washed when subjected to mercuric intensification?" It is usual to recommend very thorough washing when this process is undertaken in order to avoid subsequent deterioration of the negative through yellow stains. Dr. Vogel holds that these stains may be traced to imperfect fixing, and that, if this process is thoroughly carried out, five to six minutes' washing in running water prior to the mercury bath is ample, unless the plates have extremely thick films. After the plate has been bleached, a second washing for five to six minutes will suffice before transferring it to the ammonia bath; but the second washing may be reduced to half a minute if sulphite of soda be used instead of ammonia. To facilitate the removal of the bichloride of mercury from the film, it is desirable to add common salt to the solution of bichloride of mercury. It also expedites the solution of the bichloride of mercury. The following proportions are given:—

Bichloride of mercury	20 grammes.
Common salt	40 grammes.
Water	1000 c. c.

The salt renders the addition of bromide of potassium to the bath unnecessary. It has a similar effect and is less expensive. It is very desirable to keep the bichloride bath in an acid condition by adding hydrochloric acid until blue litmus paper is turned distinctly red. This will keep the solution quite clear. The formation of a white deposit indicates that the bath has become alkaline. The deposit has a tendency to adhere to the film, and is then difficult to remove.

Metol-hydroquinone.

H. Quartz, in the "Atelier des Photographen," recommended the following formula, which, subject to various modifications, may be taken as a stock solution for many kinds of development:—

No. 1.

Water	500 c. c.
Metol	5 grammes.
Hydroquinone	1 gramme.
Bromide of potassium (10 per cent. solution)	60 drops.
Hyposulphite of soda (10 per cent. solution)	60 drops.

No. 2.

Carbonate of potash	20 grammes.
Water	250 c.c.

The addition of hyposulphite of soda has a retarding action, and keeps the shadows clear in the case of over-exposure. In development with ferrous oxalate its action is the opposite, being in that case an accelerator and producer of fog. For instantaneous exposures, take three parts of No. 1 and one part of No. 2. For time exposures, or where over-exposure is suspected, begin with a small quantity of alkali, say 10 parts of No. 1 to one part of No. 2, increasing the latter as may be thought desirable. Development begins at once in the case of instantaneous exposures, and it is complete in two or three minutes. Several plates may be developed in succession in the same solution, which does not lose its activity. A mixture of old and new developer may be used with much advantage for time exposures. The developer may also be used for Velox paper. For the carbon variety use three parts of No. 1 and one part of No. 2, and for special portrait add an equal quantity of water. In the latter case development is slower, and the pictures show more contrast than with the developer recommended by the makers of the paper. For bromide paper, take three parts of No. 1 and one part of No. 2, and dilute with five times the quantity of water. Lantern plates may be developed with six parts of No. 1, one part of No. 2, and seven parts of water. The tone may be modified by varying the strength of the developer. Black tones may be secured with a concentrated developer, whilst the addition of water tends to warm brown tones.

Mounting Enamelled Prints.

The "Photographische Wochenblatt" states that a highly glazed surface may be preserved if the prints, after fixing and washing, are immersed in a dilute bath of formalin (1 to 4). Before squeegeeing them upon glass or ferrotype plates they should be washed in two or three changes of water. The prints may then be mounted with paste upon card in the ordinary way, and they will not lose their gloss. When they have been treated in this manner, the prints may even be immersed in water before mounting without much detriment to the glaze. If they are dried off with blotting-paper and fibres remain upon the film, they may be rubbed off when the print is dry, as the formalin destroys the adhesiveness of the gelatine.

Nickel, to Clean.

The "Photographische Chronik" recommends a bath of 2 parts of sulphuric acid to 100 parts of alcohol. Immerse the articles in the bath for a few seconds, rinse with water, and dry them. They may be polished in the usual manner.

Over-exposure, to Remedy.

The Belgian photographic paper, "Helios," gave prominence to the following method of curing over-exposure, which was communicated to the Berlin Photographic Society by H. Schmidt, of Munich. If the plate shows signs of over-exposure by flashing up immediately it is placed in the developer, it should be taken out at once and well washed under the tap. The plate should then be bathed for a few minutes in a solution of 5 grammes of nitrate of silver in 100 c. c. of distilled water, and development should afterwards be effected by pouring a small quantity of developer upon the plate held by one corner as in coating with collodion, the object of this being, of course, to retain as much nitrate of silver in the film as possible. If this process of physical development does not give sufficient density, the negative must be intensified, and for this purpose H. Schmidt prefers the following pyro-silver intensifier:—

No. 1.

Pyrogallic acid	10 grammes.
Distilled water	200 c. c.

No. 2.

Nitrate of silver	4 grammes.
Citric acid	6 grammes.
Distilled water	200 c.c.

For use dilute 4 c. c. of No. 1 with 100 c. c. of water, and when about to intensify add 4 c. c. of No. 2. For a half-plate, 25 c. c. of solution should suffice, and, as the solution should be freshly mixed, it should not be prepared until wanted. It is preferable to intensify before fixing. Herr Schmidt says the process gives excellent results with plates which have received six to ten times more than the normal exposure. Although this limit is within the control of the ordinary means of development, the process seems worth consideration.

Permanganate Reducer.

Professor Namias suggested the following as a reducer which keeps well, and obviously does not require the negative to be absolutely free from hypo:—

Potassium permanganate	1 part.
Sulphuric acid (strong)	2 parts.
Water	2000 parts.

The dish must be continually rocked whilst the reduction is taking place, and the solution cannot be used over again. If the gelatine is stained brown, it can be removed by bathing in a 1 per cent. solution of oxalic acid. The above solution, when made double the strength, may be used to produce contretype. The negative should be fully exposed, and developed with a hydroquinone developer rich in bromide as long as possible without producing fog; the negative should then be rinsed well, and immersed in the permanganate solution, when the image will dissolve, leaving the silver bromide unaffected by light intact, and this, after exposure to light, may be developed in open daylight, and the following should be used:—

Metol	10 parts.
Sodium sulphite	40 parts.
Potassium hydrate	10 parts.
Water	1000 parts.

Persulphate of Ammonia.

In a paper read before the Edinburgh Photographic Society Dr. H. Scott Lauder made the following reference to the practical applications of this reducer: If the negative has been dried, it should be soaked in water for at least half an hour to soften the film.

I find that the most workable strength for the solution in which the negative is to be immersed is about three per cent., say 15 grains, to each ounce of water. It dissolves easily, and, as it appears to be unstable in solution, it should be freshly dissolved shortly before use.

When the desired effect is produced, the action can be stopped at once by immersing the negative for a minute of two, after a slight wash under the tap, in a 10 per cent. solution of sulphite of soda. The plate should then be well washed and dried. The silver image acquires a slight pinkish hue, which becomes deeper if left too long in the sulphite of soda solution.

Ammonium persulphate, although a powerful solvent of metallic silver, has no chemical effect on silver bromide. Advantage can be taken of this property to make reversed negatives by contact direct from the original negative, and also to make positives instead of negatives direct from the camera exposure.

To make a reversed negative by contact from the original negative, the process is roughly as follows: The exposure having been made in a printing frame, as for a lantern slide, the plate is developed in the usual way; but, instead of being put into the fixing bath, it is placed in a strong solution of persulphate, from 6 per cent. to 10 per cent., by which the positive silver image is dissolved out of the film. The bromide of silver remaining can now, after a short exposure to light, be developed, and forms, of course, a negative image. To make a positive direct from an exposure in the camera, the procedure is the same, the negative image in this case being first removed, and the positive which is left being developed and fixed.

I made several attempts to produce a reversed negative by this process, but without much success. They all turned out very flat and foggy affairs. It seems very difficult to get rid of a residuum of reduced silver; but, bad as they are, I pass round the best of them, to show that the process is practicable, if not very practical.

I hope I have made it clear that persulphate of ammonia has put a new power into the hands of photographers. The golden rule, to expose for the shadows and let the high lights take care of themselves, can now be carried out to the utmost limit without misgiving.

A whitewashed cottage in full sunlight, framed in dense foliage, need not be passed by, development may be pushed to any extent to secure detail in an under-exposed foreground, and printable clouds can be recovered from the densest sky.

In portraiture, likewise, the modelling of features lost in density can be reclaimed, and the folds of a white dress will reappear. Old negatives, put aside as hopelessly hard, will now again see the light, and will be transformed by this wonder-working reducer into satisfactory printers.

Physiological Effects of Modern Photographic Developers.

Considering the enormous popularity of photography, says a writer in "Der Amateur Photograph," and the consequent widespread use of developing solutions, it is important to review their physiological effects by the light of experience.

Developing agents are offered to us in commerce either as colourless powders or small crystals. They are dissolved for use in water, and alkaline salts are added. These solutions are brought into contact with the hands and fingers of the operator. It is, of course, a very seldom occurrence that developers, in their original state or in solution, are taken into the stomach. But it is desirable, nevertheless, to take this opportunity to point out that many of our modern developers, and especially pyrogallol, must be classed with poisons. But it is of greater interest to the photographer to learn the conditions under which alkaline solutions have a deleterious effect upon the skin of the hands and fingers, causing painful inflammation often difficult to cure. Experience has shown that few persons exhibit a decided susceptibility to the action of developing solutions, and it has likewise been conclusively established that the alkali, as well as the developer, is capable of acting upon the skin. In the majority of cases that have come under observation, there can be no doubt that the alkali was the cause. With regard to the developing substances, only one is known to have caused inflammation, viz., metol, and that only in a few cases.

It is by no means unimportant which alkali is used to making up the developing solution. Developers like amidol, which are rendered active with the weaker alkalies, such as sulphite of soda, may be considered harmless. There is no case on record in which the amidol developer has been the cause of inflammation. Not until we come to the alkaline carbonates, such as soda, and, especially potash, do we meet with any complaints, and it is noteworthy that those developers which require a considerable quantity of alkali are the more troublesome, whilst those with which little alkali is used, such as eikonogen or the more recent imogen-sulphite, may also be regarded as harmless. When the caustic alkalies are used there is increased danger, but here we must also discriminate and ascertain whether the alkali combines with the developer and forms a phenolate, or merely mixes with the solution. Rodinal is a characteristic example of the former, as only sufficient alkali is used to convert the para-amido-phenol $\left(C_6H_4{}^{OH}_{NH_2}\right)$ to phenolate $\left(C_6H_4{}^{ONa}_{NH_2}\right)$. (See the instructions for the use of para-amido-phenol.) In this way the corrosive action of the caustic alkalies is diminished and their deleterious effect upon the skin reduced to a minimum. The case is quite different when the developer does not combine with the caustic alkali and form a salt, as, for instance, when para-phenylendiamine $\left(C_6H_4{}^{NH_2}_{NH_2}\right.$, meta-carbol$\left.\right)$ is used. Such developing solutions are as strongly alkaline, and have the same corrosive effect, as a solution of caustic alkali of corresponding strength. It is scarcely possible to work long with these developers.

Platinum Toning.

The "Gazette du Photographe Amateur" published the following toning process, recommended by M. A. Courreges, for very rich, warm, black tones. The following solutions should be prepared:—

No. 1.

Water	500 grammes.
Borax	10 grammes.

No. 2.

Water	500 grammes.
Chloride of gold	1 gramme.

No. 3.

Water	1000 grammes.
Chloro-platinite of potash	1 gramme.
Phosphoric acid	10 grammes.

A few hours before toning, mix 60 grammes of No. 1 with 60 grammes of No. 2. The solution should be neutral when used. This may be ascertained by the colour, as the yellowish tinge, due to the chloride of gold, should be discharged. Keep the bath after use as stock solution, and make fresh additions to it for each batch of prints. The prints should be well washed before toning in the gold bath, and they should be removed from the latter as soon as the high lights turn grey when examined by transmitted light. Rinse them in two changes of water, and carefully drain them to avoid diluting the platinum bath, No. 3, which should then follow. Fix and wash in the usual manner.

Poisons.

Edward Crouzel, in the "Chemiker Zeitung," recommended the following remedies for first help in case of poisoning when the cause is unknown: Give half-gramme doses of tartar emetic in hot water at short intervals. Make the person drink cold milk to which 5 per cent. of borax has been added. The milk will tend to protect the walls of the stomach, and the borax form insoluble compounds with mineral bases. To counteract collapse, give a mixture of concentrated cold coffee and Peruvian bark in equal quantities, with a little sugar and a few grammes of Hoffmann's drops. A solution of albumen may be used instead of milk. A doctor should be fetched immediately, and these remedies used meanwhile.

Preserving Cut Flowers.

The following hints, given by a reader of the "Photo-Revue," M. G. Lefebvre, may be of service to those who are interested in the photography of flowers. Cut flowers should not be placed at once in a vase. They should first be lightly sprinkled with perfectly fresh water, and, when quite wet, placed in the vase filled with the following solution:—

Water	1000 grammes.
Curd soap	30 grammes.
Chloride of sodium	3 grammes.

Cut the soap into shreds and see that it is quite dissolved. Add a small pinch of borax to the solution. This is not absolutely necessary, but the writer finds that flowers of brilliant colour retain their brightness better when a small proportion of borax is added to the chloride of sodium. If the flowers are to be kept several days, they should be taken from the vase every morning, turned downwards, and the stalks washed under a stream of running water for about three minutes. Sprinkle them with water again as on the first day, and replace them in the vase. The soap and water should be changed every two or three days. The most delicate flowers may thus be kept for several days, and the writer has seen some that have remained three weeks in splendid condition.

Purifying Gelatine.

The "Journal de la Societe Chimique" recommends that gelatine should be purified by treatment with successive baths of water, diluted solution of potash, diluted acetic acid, water, and, finally, alcohol. Most of the mineral impurities will thus be eliminated. The gelatine should then be dissolved in warm water, filtered, precipitated with alcohol, dried, pulverised, and treated with ether. In this way the mineral constituents may be reduced in certain cases to 25 per cent., and the sulphur compounds to two per cent., of their original quantities.

Pyro Development.

In Dr. R. E. Liesegang's paper, "Der Amateur Photograph," an article was published concerning pyro development which is well worth consideration. After pointing out that pyrogallic acid was the favourite developer with the wet-plate photographer, and was followed by ferrous oxalate, hydroquinone, eikonogen, and the aniline derivatives, the writer alluded to the fact that photographers are returning to pyro, and that this tendency cannot be due to pure conservatism. R. E. Liesegang has often referred to the compound nature of the image formed by pyro development, the negative being composed of metallic silver plus stain. This almost eliminates the risk of over-exposure. On the other hand, pyro is recommended by manufacturers of shutters as the best developer for instantaneous work. These two extremes suggest that pyro is probably the developer giving most latitude. The writer of the article recently photographed a fresco painting, and gave four days' exposure at f-32 with a deep orange screen. The light was good. A window, glazed with ground glass, was in the field of view, but, notwithstanding this was immensely over-exposed, a good negative was obtained, the window being as truly rendered as the fresco painting. An old oxidised pyro developer, with which six other plates had been developed, was used. In cases of over-exposure, a stale developer is recommended. Bromide of potassium merely retards, but stale pyro corrects. The following question was asked by Dr. Seitz, "Should development be adjusted to exposure, or exposure adjusted to development?" The writer answered: "In studio work, where the exposure can be accurately timed, the latter should be made to correspond with the developer, which should be very energetic. By such means the exposure may be reduced, and time saved in development. In work, however, where violent contrasts of light and shade exist, the development must be modified and suited to the exposure."

Reduction of Negatives.

In the "Photographische Chronik" a communication was published from C. Mischewski, of the Photo-chemical Laboratory of the Technical High School, Berlin, concerning the action of cerium sulphate as a reducer. Sulphate and nitrate of cerium have been recommended by MM. Lumiere and Seyewetz as reducers, and they seem free from the disadvantages attending the use of ferricyanide of potassium and hyposulphite of soda. C. Mischewski's formula is as follows:—

Distilled water	100 c. c.
Sulphite of cerium	10 grammes.
Strongest sulphuric acid	4 c. c.

Dilute this stock solution with three times the quantity of water for use. The bath at this srength works with moderate rapidity, and the negative retains its blue-black colour. The solution does not deteriorate if kept in the dark. If the negative is very dense, the concentrated solution may be used, and it acts with such rapidity that the negative is reduced to printing density in a very short time. The concentrated solution appears to act more upon the high lights than does the usual ferricyanide bath.

Reflection as an Aid to Exposure.

The editor of the "Photographisches Wochenblatt" gave an account of some experiments he has made to utilise the light which passes through the film during exposure without affecting it. That such is the case may readily be proved by placing one plate behind another in the dark slide, upon development an image will also be found upon the second plate. Herr Gaedicke points out that the first attempt to utilise this waste light by turning it back to the film was made by Brewster. Unfortunately, the thickness of the glass presents difficulties in applying the idea to plates, but films, being much thinner, are comparatively free from drawback. A pack of six films was exposed for 120 candle metre seconds behind a sensitometer. The following numbers appeared after simultaneous development:—

Film	1	2	3	4	5	6
Sensitometer No.	15	11	8	4	1	0

A number of experiments were then made to obtain by trial and error three negatives exactly corresponding with films Nos. 2, 3, and 4. The exposures were converted to seconds and used to express the quantity of light which each plate had received. This gave the following result:—

	Exposure Given.		Calculated Exposure.	
Film 1	120 0	c. m. s.	—	
,, 2	33·3	,,	33·3	$= \frac{5}{18} \cdot 120$
,, 3	9·4	,,	9·25	$= \frac{25}{324} \cdot 120 = (\frac{5}{18})^2 \cdot 120$
,, 4	2·6	,,	2·57	$= \frac{125}{5832} \cdot 120 = (\frac{5}{18})^3 \cdot 120$
,, 5	—	,,	0·71	below the inertia of the plate.
,, 6	—	,,	0·2	

It follows that each film absorbs 13-18 and transmits 5-18 light. The co-efficient of absorption is, therefore, 0.722, and of transmission 0.278.

The peculiar fact was also observed that comparatively small quantities of light did not deviate in their effect upon the film, and were absorbed and transmitted in similar degrees. Experiments were then made by exposing films backed with paper and tinfoil. The latter was, of course, the more efficient. If the transmitted light could be totally reflected, the normal exposure should be reduced to 13-18, but, as there is some loss in reflection, it was found by experiment that ¾ normal exposure was the correct proportion. It follows, therefore, that exposure may be reduced 25 per cent. when films backed with tinfoil are used, a consideration of some importance for instantaneous photography under unfavourable conditions. When using films backed with tinfoil, two important facts must be remembered. As the image is partly at the back of the film, the developer must be given sufficient time to bring out the full exposure. As a film saturated with developer can only be freed from it by prolonged washing, it is desirable to fix the film before exposing it to light.

Restoring Yellow P.O.P.

Professor Namias, in "Il Progresso Fotografico," pointed out that gelatino or collodio-chloride paper which has become yellow by improper keeping can be restored to its pristine whiteness by immersion for some minutes in a two per cent. solution of ammonium persulphate rendered slightly alkaline with ammonia. When dried, the paper thus treated will yield excellent prints, which, however, are not quite so intense as those made on fresh paper; but this loss of intensity may be got over by the addition of a small quantity of silver nitrate to the persulphate solution, and that then it is difficult to detect any difference between such prints and those on freshly prepared paper.

Retouching with a Knife.

In regard to the use of the knife in retouching (wrote Mr. Scherholz to THE BRITISH JOURNAL OF PHOTOGRAPHY), a few remarks from a practical worker may be of some assistance. In the first place, a good knife is necessary, and I know of nothing better than what is called a microscopic dissecting knife. It is best to have two for use—one rather broad towards the point, the other tapering to a point almost as fine as a pen. The broad one can be used to remove large masses, such as objectionable parts in a lady's dress, &c.; while the smaller one is very useful in removing false lights in the eyes, stray hairs protruding from the hair or beard, blemishes in the face, protruding bones in the neck, reducing the size of the hands and wrists, &c. In the next place, a proper edge is desirable, because without this it is impossible to use the knife satisfactorily. For this purpose I find that a piece of Arkansas stone answers well. It should be used with a little oil. Care is necessary, however, when sharpening the knife, not to get a saw edge, as it is impossible to effectively use it when this is the case. To obviate this, hold the knife rather flat on the stone while rubbing, bearing rather lightly, and be sure to sharpen both sides as equally as possible. Always rub the parts of the negative on which you wish to use the knife with the retouching medium, because if this is neglected you are liable to scrape deeper than is necessary. It is also advisable to test the edge of the knife on some part of the negative, which is not to be printed from. Sometimes, owing to negatives being of a slight yellowish colour, those parts which have been scraped will appear too transparent when varnished. This can be remedied by using a very finely-pointed lead, and going over those parts just lightly enough to fill in where the knife has cut too deep.

Reversal.

The "Moniteur de la Photographie" reprinted an article from the "Photo-Revue," by Louis Fuilla, concerning direct positives, in reply to the objection that they are the wrong way round when taken in the camera. He points out that a second positive may be obtained by a fresh exposure in the printing frame, by which means the correct position of right and left will be restored. He gives the following table as the result of numerous experiments, from which an idea may be obtained of the exposure that should be given:—

	EXPOSURE.							
	Very hard.		Hard.		Medium.		Thin.	
	m.	secs.	m.	secs.	m.	secs.	m.	secs.
In sunlight	2	15	1	45	1	15	0	45
In shade out of doors	10	—	7	—	5	—	3	30
In a room, two metres from an open window	25	—	20	—	17	—	15	—

He remarks that it is preferable to expose in the shade if the original is of medium density or thin, and that a green glass should be used if such exposures are made in sunlight for sake of speed. He also finds that, the more rapid the plate, the more satisfactory is the result. Unfortunately, the writer gives no indication of the speed of the plates used for compiling the table quoted above, and it will be seen that the exposures do not harmonise. The exposure indoors varies between 15 and 25 minutes, whilst in sunlight it ranges from 45 seconds to 2¼ minutes.

Reversed Negatives.

In a paper communicated by Professor Namias to the Congres de Chimie appliquee et de Photographie, the following process was recommended for obtaining reversed negatives. After full exposure of the plate, which should have a very even film, develop with the following developer:—

Sulphite of soda	30 grammes.
Carbonate of potash	50 grammes.
Glycerine	10 grammes.
Bromide of potassium	1 gramme.
Water	1000 c. c.

The plate is left in the developer until those parts corresponding to the high lights of the negative are visible from the back. To obtain this effect it is necessary that the plate should remain at least half an hour in the bath. Slight fog is immaterial. Rinse the plate under the tap and immerse it in the following bath:—

Permanganate of potash	30 grammes.
Sulphuric acid (commercial)	20 c. c.
Water	1000 c. c.

This bath dissolves the silver reduced by development, and as soon as the operation is complete clear the image by immersion in a one per cent. of oxalic acid. This may be done by daylight. The plate should then be redeveloped. The following solution has been found most suitable:—

Metol	10 grammes.
Sulphite of soda	40 grammes.
Caustic soda	5 grammes.
Water	1000 c. c.

Wash and dry the negative, and if too dense reduce it with permanganate of potash, acidified with sulphuric acid.

Silvering Mirrors.

The "Chemiker Zeitung" gave the following directions:—I. Dissolve 30 grammes of nitrate of silver in 240 c. c. of distilled water, and add ammonia, drop by drop, until the precipitate first formed is redissolved. Avoid adding ammonia in excess. Filter and refilter through the same double filter paper until the liquid is quite clear. Make up the quantity with distilled water to 480 c. c. Keep the solution in a clean flask, in a cold, dark place.

II. Dissolve 0.75 grammes of Rochelle salt in 300 c. c. of water, heat to boiling point and add 0.166 gramme of nitrate of silver, stir with a clean glass rod, and boil for ten to fifteen minutes, until the solution acquires a grey colour. After filtering, dilute the solution to 480 c. c., pour it into a clean flask, and let it stand from six to eight hours in a cool, dark place.

For use, take 30 c. c. of Nos. I. and II., mix, and add 120 c. c. of distilled water. Clean the glass very carefully, pour the fluid upon it and let it stand for about an hour, for precipitation of all the silver. Rinse the glass with water and stand it on end to dry.

Spotting Medium.

The "Photographische Chronik" mentions that an excellent medium may be prepared by scraping away the dense portions of old negatives. When a sufficient quantity has been secured, place it in a small bottle, add a little water, a few drops of acetic acid, and dissolve by means of heat. A thickish paste is thus obtained, which has the same properties as the negative, and which is easily used with the brush. The paste may also be prepared from the cuttings of toned prints.

Studio Roof, the.

The "Camera Obscura" contained an article upon this subject from the pen of Herr Alfred Parzer-Muhlbucher. To those who think of building their own studios he recommends the use of good ordinary window glass, and, as it is generally slightly curved, care should be taken in glazing that the curves are in the same direction, preferably with the concave side upwards. If T iron is used for the rafters, there is great advantage in using the pattern with underneath channels, as it carries off any excessive condensation of moisture or drip. The durability of a roof depends largely upon the material used for fixing the glass in position. Changes in temperature cause unequal expansion of the glass and rafters, and the desideratum is a putty that combines sufficient elasticity and adhesiveness to keep the joints water-tight. The best putty is stiff and dries yellowish. If soft and white, it should not be used for the purpose. The following is recommended as an excellent composition instead of putty. Tear ordinary newspaper into small pieces, place it in an enamelled vessel and cover it with caustic potash lees. Boil it and add with constant stirring one-third the quantity of turpentine. Thoroughly mix and keep the solution hot; then add the following ingredients, which must also be dissolved in boiling turpentine:—

Ordinary pitch	10 parts.
Resin	3 parts.
Gutta percha	10 parts.
Wood tar	2½ parts.

The solution should be well stirred and boiled till it becomes a stiff paste, and should be used whilst still warm. The composition may be good; but we should advise considerable care in its preparation, as it must be highly inflammable.

Sulphocyanide of Lead and Gold Bath.

Professor Lainer communicated a note on this subject to the "Photographische Correspondenz," and points out that most of the sulphocyanide baths contain far too much of this salt. A bath which contains 24 parts of sulphocyanide to the thousand attacks the delicate half-tones of the print, causes pit markings in the gelatine, and softens the skin of the fingers, and frequently gives double tones, and it does not tone well. He has decreased the proportion of sulphocyanide to 2.5 parts per 1000; this generally gives brown tones, though blue-violet tones are those most generally desired. By the addition of lead nitrate this is attained, but the lead salt must not be added hap-hazard, for, if lead nitrate be added to sulphocyanide of ammonium solution, a precipitate of sulphocyanide of lead is formed, but, if it be added to a solution of sulphocyanide of gold, there is no precipitate, and there is formed an excellent toning bath which gives excellent tones in from 20 to 25 minutes. The following stock solutions should be prepared:—

A. Ammonium sulphocyanide ....1000 grains, water 1000 c c.
B. Potassio-chloride of gold .... 1 grain, water 100 c. c.
A. Ammonium sulphocyanide ....100 grains water 1000 c. c.

For use mix:

Water	1000 c. c
Solution A.	25 c. c.
Solution B.	50 c. c.
Solution C.	30-50 c. c.

The above quantity of bath is sufficient for from forty to fifty prints 13 × 18 cm. The prints should be washed before toning in four or five changes of water, and fixed in a ten per cent. solution of hypo.

Three-colour Transparencies.

M. Leon Vidal described the following method of preparing trichromatic transparencies by superposition in the "Bulletin du Photo-Club":

Three negatives are obtained, one for the red days, another for the green, and the third for the violet.

The taking screens are made as follows:—

The Reddish-orange: Yellowish eosine, 2 parts; naphthol yellow, 1 part; water, 100 parts.

The Green Screen: Sulpho-green I., 2 parts; naphthol yellow, 1 part; water, 100 parts.

The Violet Screen: Methylene blue, 2 parts; Paris violet, 2 parts; water, 100 parts.

Filter, and allow the plate to be coloured to soak for five minutes, rocking the dish all the time.

Ordinary dry plates, fixed in hypo and well washed and dried, may be used, but they must be placed next the plate.

Lumiere's panchromatic plates may be used, but orthochromatic plates, specially sensitive to red, to yellow, and the ordinary plate, may be used equally as well.

In order to obtain the transparencies thin, rollable celluloid films should be used, and cut to the required size, and immersed for two minutes in a bath of bichromate of potash, 0.75 per cent., and then dried in the dark. They should be exposed behind the negative, with the negative in contact with the film, and require from five seconds to two minutes in direct sunlight, but it is preferable to use an actinometer.

Development should be effected in hot water at about 40° to 50° C., and then the silver bromide should be dissolved out by clean hypo, and the film well washed.

For the blue film methyl green should be used; for the red, erythrosine; for the yellow, a mixture of yellowish eosine and naphthol yellow. The films should be soaked in these solutions till of the desired intensity, and then, when dry, they may be fitted together.

Transparencies, the Colour of.

There was a short account in the "Photographische Correspondenz" of some experiments made by Dr. Eder concerning the colour of the image upon chloro-bromide plates as effected by the nature of the light to which they are exposed. Edwards's plates and hydroquinone developer were used. The light of a paraffin lamp and ordinary daylight favoured blackish tones. Incandescent gaslight, under otherwise similar conditions, tended to brownish tones. This seems to indicate that the chloride is more affected than the bromide by exposure to incandescent gaslight, which is richer in violet rays than the light of a paraffin lamp. The maximum sensitiveness of chloride of silver is nearer the violet end of the spectrum than that of bromide.

MISCELLANEOUS INFORMATION.

THE LONDON COUNTY COUNCIL'S CARBIDE OF CALCIUM REGULATION.

THE following is an abstract of the Regulations as to the Keeping, Sale, and Conveyance of Carbide of Calcium in the County of London :—

This abstract has no legal validity, and is intended only for the information and guidance of the persons concerned. For further information reference should be made to the Petroleum Acts, and to the Orders in Council dated 20*th February*, 1897, *and* 7*th July*, 1897.

General.

1. By an Order in Council, dated 26th February, 1897, carbide of calcium can only be kept in pursuance of a licence granted by the local authority.

2. By a further Order in Council, dated 7th July, 1897, not exceeding 5 lbs. of carbide may be kept without licence, provided it is kept in separate substantial hermetically-closed metal vessels containing not more than 1 lb. each.

NOTE.—The Order does not provide for the keeping of any quantity except in a closed vessel. Only one vessel should, therefore, be opened at a time, and the quantity of carbide, not exceeding 1 lb., required for use, should be at once placed in the generator, which should be immediately closed. If any carbide remain in the storage vessel, such vessel should be at once re-closed.

3. Where carbide of calcium is—

(*a*) Kept at any place ; or

(*b*) Sold or exposed for sale,

the vessel containing it shall bear a label stating in conspicuous characters, the words, 'Carbide of Calcium,' 'Dangerous if not kept dry,' and with the following caution :—'The contents of this package are liable if brought into contact with moisture to give off a highly inflammable gas,' and also the name and address of the owner or vendor.

Licences.

4. Application to the Council for a licence to keep carbide of calcium at any place in the County of London (except the City of London) must be made upon the form provided for the purpose, which can be obtained by application in writing, addressed to the Chief Officer, Public Control Department of the London County Council, 6, Waterloo-place, S.W.

5. Every application must be accompanied by a fee of 5*s*. in money, or, if sent throgh the post, by cheque or postal order for that amount payable to the order of the London County Council. The fee will be returned to the applicant if the licence be not granted.

6. Every application must state—

(*a*) The quantity of carbide of calcium which the applicant desires to keep.

(*b*) The proposed place and method of storage;

(*c*) If the carbide is only to be kept for sale in closed vessels, or if it is to be used in the manufacture of acetylene gas.

7. Carbide of calcium should be kept in strong metal vessels, and—

(*a*) Such vessels should be so constructed and closed as to prevent the admission of water or atmospheric moisture.

(*b*) Such vessels should only be opened for the time necessary for the removal of any required quantity of carbide, or for the refilling of the vessels.

(*c*) No one vessel should have a greater capacity than 3696 cubic inches (equal to a cylindrical vessel, 14 inches in diameter and 24 inches in depth).

(*d*) Every vessel of a greater capacity than 2 lbs. should be provided with a lock or be placed in a locked receptacle so as to prevent unauthorised persons gaining access to the contents.

(*e*) Copper should not be used in the construction of vessels for containing carbide.

8. Vessels containing carbide of calcium should not be kept inside dwelling-houses, but preferably in dry and well-ventilated outbuildings.

9. Small quantities of carbide for sale or immediate use will, however, be allowed in shops, dwelling or workshops, upon licensed premises, if the arrangements are satisfactory.

10. The Council proposes only to grant licences to keep carbide of calcium which is pure (in a commercial sense), *i.e.*, which contains no impurities liable to generate phosphoretted or siliciuretted hydrogen so as to render the gas evolved liable to ignite spontaneously.

11. Where carbide of calcium is kept for the manufacture of acetylene gas, it is desirable that such of the following precautions for ensuring safety as are applicable to the circumstances, should be adopted—

(*a*) Every apparatus for generating and storing acetylene gas should be placed in an outbuilding. (This does not apply to portable apparatus holding a charge of less than 2 lbs. of carbide).

(*b*) Such building should be separated as far as may be practicable from inhabited buildings, and should be well ventilated.

(*c*) No fire or such artificial light as would ignite inflammable gas should be taken into or near the building or place where a gas-making apparatus is situate.

12. Every apparatus (including generator and gas-holder) used for acetylene gas should as far as practicable be constructed and used so as to provide against the special risk, *i.e.*—

(*a*) Copper should not be used in any part of the apparatus.

(*b*) The various parts should be of adequate strength.

(*c*) Escape of gas from the apparatus should be carefully guarded against.

(*d*) Satisfactory provision should be made against dangerous development of heat.

(*e*) Satisfactory provision should be made against undue pressure by the employment of an adequate safety valve connected with a pipe discharging into the open air, and a suitable pressure gauge should be attached to the apparatus.

(*f*) Provision should be made for the residue of the carbide being mixed with at least ten times its bulk of water on being removed from the apparatus.

(*g*) No person should have charge of an apparatus until he has been properly instructed in its management.

13. Licences are granted for keeping carbide of calcium for periods not exceeding one year, and prior to expiration application must be made for

their renewal. Notice of the expiration, and a form of application for renewal, is sent to each licencee at the proper time.

Conveyance of Carbide of Calcium.

14. Where carbide of calcum is sent or conveyed, the vessel containing it shall bear a label stating in conspicuous characters the words, "Carbide of Calcium," "Dangerous if not kept dry," and with the following caution:— "The contents of this package are liable if brought into contact with moisture to give off a highly inflammable gas," and also the name and address of the sender.

15. Carbide of calcium conveyed to or from licensed premises must be conveyed in accordance with the conditions of the licence.

Inspection.

16. Any dealer who refuses to show to any officer authorised by the Council every or any place or all or any of the vessels in which carbide of calcium in his possession is kept, or to give him such assistance as he may require for examining the same, or to give to such officer samples of such carbide of calcium on payment of the value of such samples, or who wilfully obstructs the Council, or any officer of the Council, in the execution of these Acts and the order made thereunder, is liable to a penalty not exceeding twenty pounds.

ALFRED SPENCER, *Chief Officer.*

6, *Waterloo place, S.W., April* 21, 1899.

THE LONDON COUNTY COUNCIL'S REGULATIONS RESPECTING THE USE OF CINEMATOGRAPH LANTERNS, &c., IN PREMISES LICENSED BY THE COUNCIL.

1. No cinematograph, or other similar apparatus involving the use of a lengthy combustible film, shall be exhibited on premises licensed by the Council, until the Council has been satisfied that all reasonable precautions have been taken against accident and danger to the public.

2. Notice of any intended exhibition shall be given to the Clerk of the Council by the licensee of the premises in which such exhibition is to be given, and the licensee shall be held entirely responsible for the proper and safe use of the apparatus. Such notice shall be given at least three days before the first day of exhibition. Opportunity shall also be afforded to the Council's inspector of inspecting the apparatus before the public exhibition takes place, in order to allow time for any necessary alterations to be carried out and approved by the Council. No gangway or exit must be in any way affected.

3. The cinematograph shall stand in a suitable fire-proof room or closed sheet iron box of sufficient dimensions to allow the operators to work freely and fitting closely to the floor, which shall be covered with fire-resisting material within such room or box. The door or doors shall open outwards and be self-closing, and of the three windows which are necessary in the front face of the enclosure, the centre one shall not exceed 8 inches square, and the windows on each side shall not exceed 6 inches square; a flap screen, to cover all these three holes, shall be fitted and actuated both from the inside and from the outside of the enclosure; the space separating the audience and seats from the iron enclosure shall not be less than 2 feet in width at the sides and in the front of the enclosure, and the space at the back in which the door is situated shall not be less than 6 feet from the enclosure. The audience shall be completely excluded from the above space around the enclosure by a suitable barrier. No unnecessary combustible material shall be within the enclosure, and, as far as possible, all necessary combustible material shall be

rendered fire-proof, or shall be enclosed in fire-proof receptacles. The part of the film immediately opposite the lens shall be provided with an apparatus which prevents the film, if kindled, from burning towards either of the spools.

4 The body of the lantern shall be constructed of wood or other non-conducting material, and shall be coated inside with asbestos; it shall also have an inner lining of sheet-iron, and an air space shall be left between the iron and the asbestos lining. In the bottom of the lantern shall stand an iron tray, which shall be surrounded by a vertical edge at least 1 inch in depth. The lantern shall be provided with a metal shutter, which shall fall freely between the source of light and the condenser. This shutter shall be immediately dropped in the event of any accident to the apparatus or stoppage of the film, and shall only be raised when the film is in motion for the purpose of projection. One of the firemen of the establishment shall be in attendance near the apparatus with a wet blanket and two buckets of water.

5. Where possible the electric arc light shall be adopted as an illuminant the usual rules for securing safety in an electric installation being observed. Ether and other inflammable liquids shall not be employed under any circumstances for producing light. If limelight be used in the lantern the general regulations for its safety, which are issued by the Council, shall be complied with, and any additional precautions which the Council may deem necessary for securing safety shall also be adopted. The use of acetylene gas will not be permitted.

6. The space in which the cinematograph stands shall, where possible, be illuminated by electric glow lamps; but a miner's safety lamp may be substituted, if necessary. No naked gas or oil flames, or matches shall be allowed in the space. The lighting of the hydrogen flame in the lantern shall be accomplished by means of an electric lighter.

7. The films, when not actually passing through the lantern, shall be kept enclosed in metal cases. The film which is passing through the lantern shall be re-wound, either automatically or by hand, upon another bobbin as fast as it emerges from the lantern front.

8. Not less than two, nor more than three, operators shall be engaged within the lantern space, and no other persons shall be within the lantern enclosure during the exhibition. The whole duty of one of the operators shall consist in taking charge of the film after it has passed through the lantern.

9. The licensee shall be held responsible for the employment of competent' experienced and trustworthy operators, and shall be prepared at any time to supply to the Council satisfactory credentials in this respect.

10. Smoking within the lantern space shall be absolutely forbidden at all times.

11. The Council reserves to itself the right of modifying any of the above regulations and of requiring the adoption of any further precautions, in addition to those specified above, as circumstances may require.

G. L. GOMME, *Clerk of the Council.*

N.B.—Printed copies of these regulations, together with those respecting the use of limelight, will be supplied on application to the Clerk of the Council.

THE POISONS ACT.

THE following is a list of poisons scheduled in the Poisons Act.

SCHEDULE A.

Part 1.—Arsenic and its preparations, prussic acid, cyanide of potassium and all metallic cyanides, strychnine and all poisonous vegetable alkaloids and their salts, aconite and its preparations, emetic tartar, corrosive sublimate, cantharides, savin and its oil, ergot of rye and its preparations.

Part 2. Oxalic acid, chloroform, belladonna and its preparations, essential oil of almonds unless deprived of its prussic acid, opium and all preparations of opium or of poppies.

The clauses of the Act which relate to the sale of poisons by unqualified persons are two in number, and are as follows:—

From and after December 31, 1868, any person who shall sell or keep an open shop for the retailing, dispensing, or compounding poisons, or who shall take, use, or exhibit the name or title of chemist and druggist, or chemist or druggist, not being a duly registered pharmaceutical chemist, or chemist and druggist, or who shall take, use, or exhibit the name or title pharmaceutical chemist, pharmaceutist, or pharmacist, not being a pharmaceutical chemist, or shall fail to conform with any regulation as to the keeping or selling of poisons made in pursuance of this Act, or who shall compound any medicines of the British Pharmacopœia except according to the formularies of the said pharmacopœia, shall for every such offence be liable to pay a penalty or sum of 5*l.*, and the same may be sued for, recovered, and dealt with in the manner provided by the Pharmacy Act for the recovery of penalties under the Act; but nothing in this Act contained shall prevent any person from being liable to any other penalty, damages, or punishment to which he would have been subject if this Act had not passed.

It shall be unlawful to sell any poison, either by wholesale or by retail, unless the box, bottle, vessel, wrapper, or cover in which such poison is contained be distinctly labelled with the name of the article and the word poison, and with the name and address of the seller of the poison; and it shall be unlawful to sell any poison of those which are in the first part of Schedule A to this Act, or may hereafter be added thereto under section two of this Act, to any person unknown to the seller, unless introduced by some person known to the seller; and on every sale of any such article the seller shall, before delivery, make or cause to be made, an entry in a book to be kept for that purpose stating, in the form set forth in Schedule F to this Act, the date of the sale, the name and address of the purchaser, the name and quantity of the article sold, and the purpose for which it is stated by the purchaser to be required, to which entry the signature of the purchaser and of the person, if any, who introduced him shall be affixed; and any person selling poison otherwise than is herein provided shall, upon a summary conviction before two justices of the peace in England, or the sheriff in Scotland, be liable to a penalty not exceeding 5*l.* for the first offence, and to a penalty not exceeding 10*l.* for the second or any subsequent offence, and for the purposes of this section the person on whose behalf any sale is made by any apprentice or servant shall be deemed to be the seller: but the provisions of this section, which are solely applicable to poisons in the first part of the Schedule A to this Act, or which require that the label shall contain the name and address of the seller, shall not apply to articles to be exported from Great Britain by wholesale dealers, nor to sales by wholesale to retail dealers in the ordinary course of wholesale dealing, nor shall any of the provisions of this section apply to any medicine supplied by a legally qualified apothecary to his patient, nor apply to any article when forming part of the ingredients of any medicine dispensed by a person registered under this Act; provided such medicine be labelled, in the manner aforesaid, with the name and address of the seller, and the ingredients thereof be entered, with the name of the person to whom it is sold or delivered, in a book to be kept by the seller for that purpose; and nothing in this Act contained shall repeal or affect any of the provisions of an Act of the Session holden in the fourteenth and fifteenth years in the reign of Her present Majesty, intituled *An Act to Regulate the Sale of Arsenic.*

A TABLE OF POISONS AND ANTIDOTES. Compiled by Mr. J. V. Elsden.

	Poisons.	Remarks.	Characteristic Symptoms.	Antidote.
Vegetable Acid.	Oxalic Acid, including Potassium Oxalate	1 drachm is the smallest fatal dose known.	Hot burning sensation in throat and stomach; vomiting, cramps, and numbness.	Chalk, whiting, or magnesia suspended in water. Plaster or mortar can be used in emergency.
Caustic Alkalies.	Ammonia Potash Soda	Vapour of ammonia may cause inflammation of the lungs.	Swelling of tongue, mouth, and fauces; oftened followed by stricture of the œsophagus.	Vinegar and water.
Metallic Salts.	Mercuric Chloride	3 grains the smallest known fatal dose.	Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting.	White and yoke of raw eggs with milk. In emergency, flour paste may be used.
	Acetate of Lead	The sub-acetate is still more poisonous.	Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums.	Sulphates of soda or magnesia. Emetic of sulphate of zinc.
	Cyanide of Potassium	*a.* Taken internally, 3 grs. fatal.	Insensibility, slow gasping respiration, dilated pupils, and spasmodic closure of the jaws.	No certain remedy: cold affusion over the head and neck most efficacious.
		b Applied to wounds and abrasures of the skin.	Smarting sensation.	Sulphate of iron should be applied immediately.
	Bichromate of Potassium	*a.* Taken internally.	Irritant pain in stomach, and vomiting.	Emetics and magnesia, or chalk.
		b. Applied to slight abrasions of the skin.	Produces troublesome sores and ulcers.	
	Nitrate of Silver		Powerful irritant.	Common salt to be given immediately, followed by emetics.
Concentrated Mineral Acids.	Nitric Acid	2 drachms have been fatal. Inhalation of the fumes has also been fatal.	Corrosion of windpipe, and violent inflammation.	Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water.
	Hydrochloric Acid	½ ounce has caused death.		
	Sulphuric Acid	1 drachm has been fatal.		
	Acetic Acid, concentrated, has as powerful an affect as the mineral acids.			
	Iodine	Variable in its action; 3 grains have been fatal.	Acrid taste, tightness about the throat, vomiting.	Vomiting should be encouraged, and gruel, arrowroot, and starch given freely.
	Ether	When inhaled.	Effects similar to chloroform.	Cold affusion and artificial respiration.
	Pyrogallol	2 grains sufficient to kill a dog.	Resemble phosphorous poisoning.	No certain remedy. Speedy emetic desirable.

INSURANCE COMPANIES AND EXHIBITIONS OF ANIMATED PHOTOGRAPHY.

In view of the increasing number of Exhibitions of animated pictures which are being held, it may be desirable that our readers should know under what conditions Fire Offices allow the use (either temporary or permanent) of cinematographs or similar apparatus. The following have been adopted by Insurance Companies:—

Rules *re* Exhibitions of Animated Pictures.

1. The lantern must be constructed of metal or lined with metal and asbestos.
2. An alum or water bath must be used between the condenser and the film.
3. The apparatus must be fitted with a drop shutter available in case of emergency.
4. If the film does not wind upon a reel or spool immediately after passing through the machine, a metal receptacle with a slot in the metal lid must be provided for receiving it.
5. If electric arc lights are used, the installation must be in accordance with the usual rules, *i.e.*, the choking coils and switch to be securely fixed on incombustible bases, preferably on a brick wall, and d.p. safety fuses to be fitted.
6. If oxyhydrogen gas is used, storage must be in metal cylinders only.
7. The use of an ether saturator is not to be permitted under any circumstances.

Position.—Preferably on an open floor with a space of at least six feet all round railed off. If in a compartment, the compartment to be lined with fire-resisting materials. In any case no drapery or combustible hangings to be within two yards.

General.—Fire buckets to be kept filled, and a damp blanket to be provided and placed close at hand.

THE EARLY HISTORY OF PHOTOGRAPHY.

The following notes, for which we are indebted to the *Abridgments of Specifications*, printed by order of the Commissioners of Patents, will be found to be of much value, bringing up, as they do, with a considerable degree of completeness, the history of photography from the earliest times till the introduction of the Daguerreotype.

Euclid, about 300 B.C., in his *Treatise on Optics* (26th, 27th, and 28th theorems), proves that he knew that the pictures of bodies seen by both eyes are formed by the union of two dissimilar pictures formed by each eye.

Galen, about A.D. 170, in the twelfth chapter of the tenth book of his work, *De Usu Partium Corporis Humani*, described the phenomena attendant upon looking at bodies with both eyes, and alternately with the right and left eye.

Licetas and Kircher, in 1646, noticed the phosphorescent influence of solar rays.

Petit, in 1722, noticed that solutions of nitrate of potash and muriate of ammonia crystallised more rapidly in the light than they did in darkness.

Scheele, in 1777, observed the dissimilar powers of the rays of the spectrum in darkening nitrate of silver; he found the violet ray to have the most blackening effect.

Scheele, in 1786, observed that nitric acid was decomposed by the chemical action of light.

Senebier, in 1791, discovered that yellow wax was bleached by the action of light.

Fischer, in 1795, observed the action of light upon the ferrocyanates of iron.

J. W. Ritter, in 1801, pointed out 'the separate existence of chemical rays in the spectrum which extend beyond the most refrangible or violet rays.'

Mr. Thomas Wedgwood and Sir Humphrey Davy, in June, 1802, published their method of copying paintings, &c., by means of the action of light upon nitrate of silver. Paintings on glass were copied by placing white paper or white leather, sensitised with this salt, behind the painting, and exposing the arrangement to solar light. This method was also employed to delineate profiles or shadows of figures, the woody fibres of leaves, the wings of insects, and the images produced by the solar microscope. Muriate of silver was found to be more sensitive than the nitrate, and both were more readily acted upon when moist than when dry. These pictures could not be fixed.

Sir Humphrey Davy, in 1802, noticed the effect of light upon the puce-coloured oxide of lead.

Mr. Robert Harup, in 1802, showed that several salts of mercury were reduced by light.

Wollaston, in 1803, discovered the action of light upon gum guaiacum.

Dr. Young, about 1803, proved the interference of the obscure chemical rays.

Seebeck, in 1810, observed the production of colour on chloride of silver by the various rays of the spectrum; the violet rays rendered it brown, the blue produced a shade of blue, the yellow preserved it white, and the red gave the salt a red colour.

Bérard, in 1812, showed that the chemical rays were polarised by reflection.

M. Nicephorus Niepce, in 1814, 'attempted to fix the pictures produced in the camera obscura, and to copy engravings by means of light transmitted through them upon substances made sensible to its action.' He used a tablet of copper coated with silver, and called his process 'heliography.'

M. Daguerre, in 1824, began experiments with the view of fixing the pictures in the camera.

M. Nicephorus Niepce, in December, 1827, submitted some pictures taken upon silvered copperplates smeared with the bitumen of Judæa to the Royal Society. The resin is rendered insoluble in certain essential oils by the action of light; on subsequent treatment with the oleaginous solvent the shadows dissolve away, and the lights are represented by the unaltered resin remaining on the plate. In order to produce a better effect, M. Niepce darkened the silver surface with a film of iodine.

Mr. William Henry Fox Talbot's researches in photography date from October, 1833, and were suggested by an unsatisfactory attempt to use the camera lucida for the purpose of sketching.

Mr. William Henry Fox Talbot, in 1834, took pictures in the camera by the action of light upon paper washed with nitrate of silver, and succeeded in fixing them. He called this art 'colotype.'

Mrs. Somerville, in 1835, made some experiments on the permeability of different bodies to the chemical rays. Copper-green glass intercepts and the emerald transmits them; red glass stops most of them, whilst the garnet transmits them.

Mr. Wheatstone, on June 21, 1838, read a paper to the Royal Society, in which he described an instrument for uniting two dissimilar pictures of solid bodies, called a 'stereoscope.' This instrument is known by the name of the 'reflecting stereoscope,' as the images are made to coincide by means of mirrors. The observer looks into two plane vertical mirrors (one being opposite to each eye) inclined to each other at an angle of 90°; the drawings, taken according to the law of perspective, are fixed to two upright planes equally inclined to the mirrors.

M. Daguerre's invention (the 'Daguerreotype') was communicated to the Academy of Sciences on January 7, 1839.

YAWNING.

From Photograph taken with the new (No. 8) Folding FRENA (Beck-Steinheil Lens).
Engraved and printed by the Swan Electric Engraving Company.

On the Norfolk Broads.

From Photograph taken with the FRENA Camera.
Engraved and printed by the Swan Electric Engraving Company.

COINS AS WEIGHTS AND MEASURES.

1 Sovereign weighs	123·274 grains
1 Shilling „	87·273 „
48 Pence „	1 lb. avoirdupois
Half-penny and three-penny piece weigh	¼ ounce
Florin and sixpence	½ „
Three pennies	1 „
4 half-crowns and 1 shilling	2 ounces
4 florins, 4 half-crowns, 2 pennies, weigh	4 „
1 Half-penny = 1 inch in diameter	

FREEZING MIXTURES.

The following mixtures will be found useful where ice is not readily obtainable—

	Ingredients.	Parts by Weight.	The Temperature at starting being 50° Fahr. the thermometer sinks.	Diminution of Temperature.
	Water	1	From + 50° to + 4°	46° Fahr.
	Nitrate of ammonia	1		
2	Water	16	„ + 50° „ + 10°	40° „
	Saltpetre	5		
	Chloride of ammonium (sal ammoniac)	5		
3	Water	1	„ + 50° „ + 7°	43° „
	Nitrate of ammonia	1		
	Carbonate of soda	1		
4	Snow	2	„ 32° „ − 5°	37° „
	Chloride of sodium	1		
5	Snow	2	„ + 32° „ − 50°	82° „
	Crystallised chloride of calcium	3		
	Crystallised sulphate of soda	8	„ + 50° „ 0°	50° „
	Hydrochloric acid	5		

EXHIBITION RULES.

The following rules for the conduct of Photographic Exhibitions have been agreed to by a conference of Judges :—

Rules.

1. The Judges' decision upon the merit of the exhibits shall be final, and they shall not be asked to decide any other point.
2. The Judges shall have full power to withhold any award, and this shall be stated in the prospectus.
3. The Judges shall have power to exclude all persons from the room while judging.
4. The Judges' expenses shall be paid.
5. The Judges shall not adjudicate upon pictures exhibited as produced with wares of special trading firms.
6. No awards shall take the forn of a money prize.
7. Where there is a champion class, pictures which have previously taken awards in OPEN classes shall be exhibited in the champion class only.

8. An award shall be made to one picture only, whether it is in print, lantern slide or other form ; but, in cases where the exhibition rules provide for slides to be exhibited in sets, the award shall be made to the best slide in the best set.

9. There shall be no distinction between amateur and profesional.

10. No production of any kind whatever from the same negative shall receive more than one award, at the same exhibition. This includes lantern slides, enlargments, &c.

11. No award shall be made to a lantern slide until it has been projected on the screen.

12. It shall be stated on the entry form to what extent the work sent for competition is that of the exhibitor.

13. That the names of those who have consented to act as Judges shall be printed in the prospectus of the Exhibition.

RECOMMENDATIONS.

14. Where the Judges make more than one award to the same competitor, all these should be published in the award list, although there be an exhibition regulation debarring a competitor from receiving more than one prize.

15. The Judges should have power to give extra awards where they may think fit.

16. In order to enhance the value of awards their number should be limited.

17. The Exhibition Comittee should not accept offers of awards from trading firms.

18. It is desirable not to have classes. Where there are classes, their number should be kept as small as possible, and divisions where made should be entirely respecting 'subjects,' such as portraiture, landscape, &c, and not such as hand-camera classes, enlargement classes, &c.

The undermentioned Judges have signified their intention of upholding the rules of all future open exhibitions :—

R. CHILD BAYLEY,
THOMAS BEDDING,
J. BULBECK,
HAROLD BAKER,
VALENTINE BLANCHARD,
F. P. CEMBRANO,
LYONEL CLARK,
FRANCIS COBB,
WALTER L. COLLS,
P. H. EMERSON,
J. GALE,
JOHN H. GEAR,
J. P. GIBSON,
JOHN A. HODGES,
FREDERICK HOLLYER,
PAYNE JENNINGS,
FRED. C. LAMBERT,
PAUL LANGE,
EDGAR G. LEE,
PERCY LUND,
A. MACKIE,
C. H. OAKDEN,
ANDREW PRINGLE,
JAMES A. SINCLAIR,
HENRY STURMEY,
W. THOMAS,
W. WAINWRIGHT,
E. J. WALL,
H. SNOWDEN WARD,
MRS. CATHARINE WEED WARD,
J. B. B. WELLINGTON.

ON THE RELATIVE POWER OF LANTERN ILLUMINANTS.

M. **Molteni** gives these as follows. His experiments were made with an ordinary lantern, in the stage of which was inserted a screen with an opening seven cm. square, similar to the marks used in mounting lantern transparencies. The distance of the lantern from the screen was so adjusted that the side of the enlarged image of the square measured one metre. The enlarged image was received on the Bunsen grease spot (commonly used in photometry), the surface of which, remote from the lantern, was illuminated by a lamp carefully standardised by means of a 'Carcel' standard, burning forty-two grammes of oil per hour. The 'Carcel' lamp is the standard of light in general use in France. It is equal to ten English standard sperm candles. The distance of the standard lamp from the screen was adjusted so as to obtain equality of illumination on each side, and the relative intensity of the various lights was calculated from the distances thus obtained. It will, of course, be understood that during the various trials the lantern was not moved from the position necessary to give an enlargement of one metre square. The following are the results obtained:—

Multiple wick oil lamps	1
Welsbach burner (No. 2) without reflector	1
Acetylene—	
1 burner without reflector	1·06
2 burners, without reflectors	1·70
3 ,, ,, ,,	3·20
4 ,, ,, ,,	4·10
5 ,, ,, ,,	4·50
Limelight—	
Oxycalcium (alcohol and oxygen)	5·80
Oxyhydrogen (coal gas and oxygen)	16·60
Oxyether (gasoline and oxygen)	18·50
Electric (continuous current)—	
Ordinary incandescent lamp 32 c p (?)	·68
,, ,, (vertical) 50 c.p. (?)	·93
,, ,, (horizontal) 50 c p. (?)	·93
Focus lamp, 100 c.p.	3·82
Arc lamp, 7 ampères	39·03
,, 10 ,,	75·61
,, 12 ,,	86·50
,, 15 ,,	117·61
,, 20 ,,	160·80

The above results might, of course, have been expressed in terms of the Carcel unit, but the author is of the opinion that the table is likely to be more useful in the form in which an ordinary multiple wick oil lamp is taken as an approximate unit, since every one who has had the merest experience in lantern matters will be able to attach a tangible value to the figures when thus expressed; as, for instance, that the oxyhydrogen light is from sixteen to eighteen times more powerful than the paraffin lamp or an arc light of seven ampères about twice the power of the oxyhydrogen light.

DARK-ROOM TABLE.

By Charles Louis Hett.

For the reduction of formulæ given in Avoirdupois and Liquid Measure into proportional parts. It is arranged so that any formula for the usual 20 ounces (1 pint) solution will, when converted, give the number of grammes or cubic centimetres in a litre of mixture. When the original formula is for any other quantity, the resulting proportions may still be used for grammes and cubic centimetres; or they may be further calculated to adjust the bulk to 1000 parts. This conversion is shown in part B of the example.

	Number of	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Weights.	Grains	0·34	0·46	0·57	0·68	0·80	0·91	1·03	1·14	1·26	1·37	1·49	1·60	1·71	1·83	1·94	2·06	2·17	·29
	Drachms (27 11/32 grains)	9·38	12·5	15·6	18·8	21·9	25·0	28·1	31·2	34·4	37·5	40·7	43·8	46·9	50·0	53·1	56·3	59·4	62·5
	Ounces (437½ grains, 16 drachms)	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
Measures.	Minims (175/192 fluid grains)	0·31	0·42	0·52	0·63	0·73	0·83	0·94	1·04	1·14	1·25	1·35	1·46	1·56	1·67	1·77	1·87	1·98	2·08
	Drachms (60 minims, 54 11/16 fluid grains) ...	18·7	25·0	31·3	37·5	43·7	50·0	56·3	62·5	68·7	75·0	81·2	87·5	93·7	100	106	113	119	125
	Ounces (480 minims, 8 drachms)...........	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000

APPLICATION OF THE TABLE.

In the following example the third column shows the simple conversion by the table into proportional parts. The fourth gives the same, adjusted to 1000 parts of water.

TONING AND FIXING BATH.

	1 Materials.	2. As commonly given.	3. Proportional parts converted by table.	4. Last column multiplied by $\frac{20}{4} = 5$
A	Sodium tungstate	180 grs.	20·6 say 20	—
	Ammonium sulphocyanide ...	300 grs.	34	—
	Hypo	6 ozs.	300	—
	Water	20 ozs.	1000	—
B	Gold chloride	15 grs.	1·71	8·55 say 9
	Water	4 ozs.	200·	1000

When in use, the quantity of gold constantly varies. Therefore 10 per 1000=1 per cent. may be used. A tube contains 1 gramme of gold chloride, and only requires to be dissolved in 100 c. c. of water.

For developing, use 100 c. c. conical graduated glass. A 500 c. c. measure is a convenience in making up solutions, but is by no means essential. Foreign medicinal water bottles contain 1 litre (1000 grammes or cubic centimetres) and are useful for solutions.

CHARACTERISTIC REACTIONS OF THE KNOWN DEVELOPING AGENTS.

[Translated from the *Photographische Correspondenz.*]

By Dr. M. Andresen.

The number of the developing substances used in photography has so considerably increased in the last decade that a summary of the characteristic reactions of these substances will be useful to the practical worker. The tabular statement will render it easy for any expert to recognise any developer which may be introduced into the market under a fancy name.

It is advisable to make the investigation in a systematic manner. The substances must be tested in a given order of reactions, so that it will be easier and more certain to determine what developing substances may be present, and then to determine by special tests what is the actual substance.

The procedure is somewhat different, according to whether the substance is in the solid or liquid form.

A. The Substance is a Solid.

A small quantity, about 1 gramme, should be finely powdered and dissolved in 100 c. c. of cold water.

(*a*) The substance will not dissolve. Test for glycin and di-amido-oxyphenol.

1. It dissolves on the addition of some solid sodium sulphite and carbonate of potash = glycin. Test the solubility of the original substance in water on the addition of hydrochloric acid (soluble) and of acetic acid (insoluble), and whether the solution, acidulated with dilute sulphuric acid, gives off the smell of quinone on oxidation with potassium bichromate (1 : 15).

2. The substance does not dissolve on addition of sodium sulphite and potash = di-amido oxyphenol. The original substance should be soluble in water in the presence of acetic acid, so that no quinone is formed on oxidation.

(*b*) A clear solution is formed. In this case all the other developing agents must be tested for.

Add to the one per cent. aqueous solution five per cent. of dry sodium sulphite and ten per cent. of potassium carbonate.

1. If a fine crystalline powder separates out = para-amidophenol. This should be confirmed by the special reactions.

2. The solution remains clear, but becomes coloured; it may be amidol, eikonogen, tri-amidophenol, pyrogallol, or di-amido-resorcin.

(*a*) If the colour is blue = amidol. Test further.

(*b*) The colour is golden yellow and does not alter on standing exposed to the air = eikonogen. Test further.

(*c*) Colour greenish, especially when shaken in a half filled bottle, and turns brown on adding a few drops of caustic soda = tri-amidophenol. Test further with ferric chloride.

(*d*) The solution is brown, which increases on shaking in the air = pyrogallol or di-amido-resorcin. Add a few drops of caustic soda.

(*aa*) The brown colour remains and quickly increases = pyrogallol. Test further by special reactions.

(*bb*) The brown colour turns blue = di-amido-resorcin.

3. The solution remains clear and bright, without any colour—brenzcatechine, hydroquinone, metol, ortol, para-amidophenol (when very dilute), or para-phenyl-endiamine. Test the original substance as to the evolution of quinone by oxidation with potassium bichromate and sulphuric.

(*a*) If no quinone is formed = brenzcatechine. Test with ferric chloride and lead acetate.

(*b*) If quinone is formed by oxidation = hydroquinone, metol, ortol, para-amidophenol, para-phenyl-endiamine.

Add to the aqueous solution of the substance some dilute sulphuric acid and shake with ether.

(*aa*) If on the evaporation of the ether a residue of long needles is left = hydroquinone or ortol. Test for the same. If the hydroquinone comes from the ortol, the original substance will give, on oxidation, the Bordeaux red colour mentioned in the table.

(*bb*) There is no residue, or but little, after evaporation of the ether = metol, para-amidophenol, or para-phenyl-endiamine. Prepare a 1 : 20

solution of the substance, add some dilute sulphuric acid, and cool the solution by the addition of ice, and then add, with stirring, as much concentrated nitrite solution to make it smell of nitrous acid.

(*aa*) If a felted mass of fine needles, separates = metol. Test according to table.

(*bb*) If there is no separation = para-amidophenol or para-phenylendiamine. To some of the clear solution, containing nitrite, add some solution of *a*-naphthol-ε-disulphonic acid (known also as Andresen's acid), made alkaline with caustic alkali.

1. The azo dye formed is of a ponceau red shade = para-amidophenol.

2. The azo dye formed is of a Bordeaux red colour = para-phenylendiamine.

B. The Developer to be Tested is an Aqueous Solution.

As aqueous solutions of developing agents generally possess keeping properties only in the presence of sulphites, these will be found in all liquid developers. In order to test this, it is only necessary to acidulate a small quantity of the solution with dilute sulphuric, and the smell of sulphurous acid will prove the presence of sulphite.

To recognise the developing agent, place a small quantity of the original solution in a little dish, and add a little concentrated caustic soda lye.

(*A*) If the solution assumes gradually an intense colour on exposure to the air.

(*a*) If the colour is an intense blue = di-amido-resorcin, a small quantity of the original solution should be acidulated with dilute sulphuric acid, and the solution boiled to drive off the sulphurous acid. a couple of drops of ferric chloride solution, and strongly diluted with water. The solution will then assume the characteristic colour given in the table.

(*b*) The solution, when in contact with the air, quickly turns brown = pyrogallol, amidol, or tri-amidophenol. A small quantity of the original solution should be placed in a dish, and a lot of dry carbonate of potash added.

1. The solution turns blue = amidol. Test further as with diamido-resorcin, or extract some of the original sulphite solution with ether, evaporate the latter, and dissolve the residue with water. Ferric chloride gives a red colour.

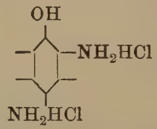
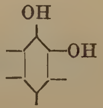
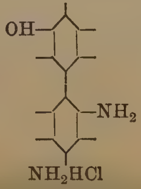
2. The solution turns brown on exposure to the air = pyrogallol. In order to confirm this, acidulate a small quantity of the original solution with hydrochloric acid extract with ether, dissolve the residue after evaporation of the ether in water, and test as suggested in the table with oxidised sulphate of iron.

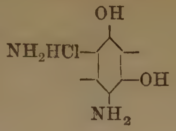
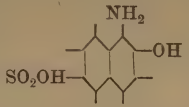
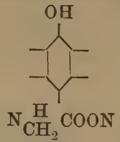
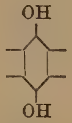
3. The solution turns a smutty green = tri-amidophenol. In this case the original solution is more yellow than the former. Test further with ferric chloride as suggested for di-amido-resorcin.

(*b*) Soda lye produces no marked change of colour = brenzcatechine, di-amido-oxyphenol, eikonogen, glycin, hydroquinone, metol, ortol, para-amidophenol, para-phenyl-endiamine.

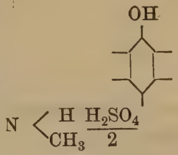
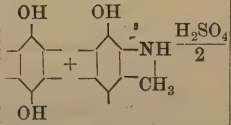
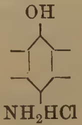
Add to some of the original solution some hydrochloric acid, slowly and with constant stirring, and note if any separation takes place, and then note if the precipitate dissolves in excess of acid.

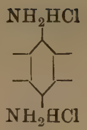
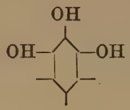
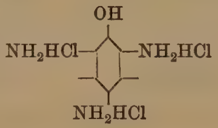
REACTIONS OF DEVELOPING SUBSTANCES.

COMMERCIAL NAME.	SCIENTIFIC NAME.	CONSTITUTION FORMULA.	CRYSTALLINE FORM.	MELTING POINT OF THE COMPOUND.	SOLUBILITY.	BEHAVIOUR TO ACIDS.
AMIDOL.	Hydrochlorate of 2·4 di-amido-phenol.		Colourless needles.	Decomposes on heating without melting.	Easily soluble in water. Sol. in alcohol and ether with difficulty.	Precipitated from aqueous solution by conc. hydrochloric acid.
BRENZCATECHINE or PYROCATECHINE.	1·2 Dioxybenzol.		Broad flakes (from benzol). Prismatic needles (from water).	104°	Readily soluble in water, alcohol, and ether; soluble in cold benzol.	—
DI-AMIDO-OXYDI-PHENAL or DIPHENAL.	Di-amido-oxyphenol.		From water in long felted needles.	148°	Readily soluble in alcohol, glacial acetic acid, and hot water; with difficulty in benzol; almost insoluble in cold water.	Soluble in dilute acids; for instance, acetic.

DI-AMIDO-RESORCIN.	Hydrochlorate of 4·6 Di-amido-resorcin.		Rhombic tables.	Decomposed by heat without melting.	Very soluble in water: sol. with difficulty in alcohol and ether.	Very readily ppt. by conc. HCl from aqueous sol.
EIKONOGEN.	Sodium salt of α_1-amido-β_1-naphthol-β_3-sulphonic acid.		Rhombic plates.	Loses at 110° 2½ molecules of water of crystallisation. On further heating, decomposes without melting.	Easily soluble in hot water; less soluble in cold; almost insoluble in alcohol and ether.	Acids precipitate the free acid in fine white needles from aqueous solution of eikonogen.
GLYCIN.	p-oxyphenyl-glycin.		Mica-like plates.	Melts with decomposition.	V. s. sol. in water and alcohol, insol. in ether.	Forms with mineral acids salts sol. in water, but not with acetic acid.
HYDROQUINONE.	1·4 dioxy-benzol.		Needles, or long hexagonal plates.	169°	Easily sol. in alcohol, ether, and hot water, less sol. in cold, sol. in cold benzol.	—

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME	SCIENTIFIC NAME.	CONSTITUTION FORMULA.	CRYSTALLINE FORM.	MELTING POINT OF THE COMPOUND.	SOLUBILITY.	BEHAVIOUR TO ACIDS.
METOL.	Sulphate of the methyl, p. amidophenol.		Needles or prisms. The free base crystallises in long needles.	Decomposes without melting. The free base melts at 87° C.	V. sol. in water, s. sol. alcohol and ether. The free base v. sol. in alc., ether, and hot water, less sol. in cold.	—
ORTOL.	Sulphate of methyl-o-amidophenol + hydroquinone (a mixture).		Sulphate of methyl of amidophenol crystallises in flat rhombic tables or prisms.	Sulphate of methyl of amidophenol decomposes on heating without melting. The free base melts at 80° with decomposition.	V. sol. in water, partial sol. in alcohol and ether (hydroquinone dissolves).	—
PARA-AMIDO-PHENOL.	Hydrochlorate of 1·4 amidophenol.		Prisms. The free base crystallises in plates.	Decomposed on heating without melting. The free base melts with decomposition at 184°.	V. sol. in water, s. sol. in alcohol and ether. The free base is v. sol. in hot, s. sol. in cold water, fairly sol. in alcohol, s. sol. in ether.	Precipitated from aqueous sol. by conc. hydrochloric acid.

PARA-PHENYLENDIAMINE.	Hydrochlorate of 1·4 phenyl-diamine.		Tricilinic tablets. The free base crystallises from ether in tablets. From water monoclinic crystals are obtained which are converted in the water into rhombic plates	Decomposed without melting. The free base melts at 140°.	V. sol. in water. S. sol. in alcohol. M. sol. in ether. The free base is v. sol. in alcohol and ether, less sol. in water.	Ppt. by conc. hydrochloric acid from the aqueous solution.
PYROGALLOL.	1·2·3-Tri-oxy-benzol.		Colourless shining needles.	Melts at 132·5°.	V. sol. in water, alcohol, and ether.	—
TRI-AMIDO-PHENOL.	Hydrochlorate of 2·4·6 tri-amidophenol.		Needles.	Decomposed without melting.	V. sol. in water, almost insol. in alcohol and ether.	Conc. hydrochloric acid ppt. the compound from aqueous solution.

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME.	BEHAVIOUR TO ALKALIES.	BEHAVIOUR TO OXIDISING SUBSTANCES.	USED AS A DEVELOPER IN CONJUNCTION WITH—	REMARKS.
AMIDOL.	Sulphite solutions on addition of potassium carbonate turn blue, with caustic potash a Bordeaux red colour.	Ferric chloride produces an intense red colour in aqueous solution. Amidol does not give quinone on oxidation.	Neutral sodium sulphite; alkalies.	—
BRENZCATECHINE or PYROCATECHINE.	Cannot be separated from an aqueous sol. by shaking with ether in the presence of caustic alkalies. After acidulation of the sol. is taken up by the ether.	An aqueous solution gives an emerald green colour with a drop of ferric chloride; without the addition of carb. soda, turns violet red. Gives no quinone.	Alkaline carbonates.	Solution of lead acetate causes a white ppt. with aqueous solution of pyrocatechine.
DI-AMIDO-OXYDI-PHENAL or DIPHENAL.	Not soluble with sulphite or alkaline carbonates, requires caustic alkalies.	Gives no quinone on oxidation.	Caustic alkalies.	The diazo compound of di-amido-oxyphenol gives, with Andresen's α-naphthol-disulphonic acid a ponceau red dye (compare para-amido-phenol).

DI-AMIDO-RESORCIN.	Aqueous sulphite sol. give with pot. carb. a yellow brown; with caustic alkalies, a blue colour.	One drop of ferric chloride sol. gives, in dilute di-amido-resorcin sol., an intense violet colour, which after a short time disappears. No quinone formed.	Neutral, alkaline, sulphites.	—
EIKONOGEN.	Alkaline solutions have a golden yellow colour.	No quinone on oxidation.	Neutral sulphites with alkaline carbonates.	—
GLYCIN.	Is converted by sodium sulphite, carbonate, and caustic alkalies into salts, which are readily soluble in water.	Gives chinone when oxidised with pot. bichrom. and sulphuric acid, with evolution of CO_2.	Caustic alkalies and carbonates.	—
HYDROQUINONE.	Not separated from alkaline aqueous sol. by agitation with ether; is removed, however, after acidifying.	Is easily converted by oxidising agents into quinone. A convenient oxidising sol. is made by dissolving 1 part of conc. sulphuric acid and 1 part of pot. bichrom. in 20 parts of water.	Caustic alkalies and carbonates.	Quinone is recognised by its pungent smell, which is readily given off on heating to boiling aqueous solutions.

REACTIONS OF DEVELOPING SUBSTANCES—*Continued.*

COMMERCIAL NAME.	BEHAVIOUR TO ALKALIES.	BEHAVIOUR TO OXIDISING SUBSTANCES.	USED AS A DEVELOPER IN CONJUNCTION WITH—	REMARKS.
METOL.	Aqueous solutions of metol, which also contain a large proportion of neutral sulphites or alkaline carbonates, contain the metol in the form of the free base.	Gives quinone on oxidation. Metol is, therefore, a phenol derivative, and not a cresol derivative, as is frequently assumed.	Alkaline carbonates.	If an aqueous sol. of metol be acidulated with dilute sulphuric acid, and some nitrite sol. added, the nitroso compound of metol $\left(C_6H_4\genfrac{}{}{0pt}{}{OH}{NCH_3}NO\right)$ separates out in fine felted needles. Ethereal sol. of the metol base on evaporation leaves the metol in the form of an oily liquid, which sets, on standing, into long rosette-shaped crystals.
ORTOL.	—	Gives, on oxidation with bichromate and sulphuric acid, a deep Bordeaux red colour, and also quinone.	Alkaline carbonates.	—
PARA-AMIDO-PHENOL.	Alkaline sulphites and carbonates ppt. the free base from concentrated aqueous solution; caustic alkalies also ppt. the free base, which is again dissolved on further addition with the formation of phenolate.	Oxidation easily produces quinone. On the addition of chloride of lime sol. to a sol. para-amidophenol mixed with hydrochloric acid, a deep violet colour is first formed, and, on further addition, yellow flocks of chloranide quinone separate.	Caustic carbonates and alkalies.	If a solution of hydrochlorate of para-amidophenol be acidulated with hydrochloric or sulphuric acid, and some nitrite solution added till the smell of nitrous acid is recognised, a diazo compound is formed in the solution which, with Andresen's α-naphthol disulphonic acid, gives, in caustic alkaline solutions, a ponceau red dye.

PARA-PHENYL-ENDIAMINE.	Separated by ether and also from alkaline caustic solutions.	Gives quinone on oxidation. Chloride of lime sol. produces, in a sol. acidulated with hydrochloric acid, quinone dichlor-diamide, which separates in yellow flocks.	Caustic alkalies.	The diazo compound of para-phenyl-endiamine gives with Andresen's α-naphthol-disulphonic acid a red-violet colour (compare para-amido-phenol). The shade of this dye is best determined by pouring some of the sol. on filtering paper, and dropping dilute acetic acid on the place.
PYROGALLOL.	Sulpho-pyrogallol solutions become brown on addition of a few drops of caustic soda. Pyro is separated by ether from sulphite sol., but not from sulphite and potash solutions.	Gives no quinone.	Alkali carbonates and ammonia.	If a dilute solution of pyro is mixed with a concentrated solution of ferrous sulphate which has become superficially oxidised, there is formed after a short time a beautiful blue colour.
TRI-AMIDO-PHENOL.	A sulphite sol. is yellowish. By addition of potash the colour becomes green, by adding caustic alkalies it becomes brown. The colours are very distinct if filtering paper be saturated with the solutions and exposed to the air.	One drop ferric chloride sol. produces a dilute aqueous sol. a deep blue colour. No quinone formed.	Neutral alkaline sulphites.	—

(*a*) If a white precipitate is formed = di-amido-oxyphenol, eikonogen, glycin, para-amidophenol.

1. The precipitate formed does not dissolve in excess of hydrochloric acid = eikonogen.

2. The precipitate dissolves on addition of more hydrochloric acid = di-amido-oxyphenol, glycin, and para-amidophenol.

(*aa*) The precipitate does not dissolve on addition of strong acetic acid = glycin.

(*bb*) The precipitate dissolves in excess of acetic acid = para-amidophenol, di-amido oxyphenol.

Acidulate a small quantity of the original solution with dilute sulphuric acid, drive off the free sulphuric acid by boiling, and add to the boiling hot solution some potassium bichromate.

(*cc*) The solution smells of quinone = para-amidophenol.

(*dd*) There is no smell of quinone = di-amido-oxyphenol.

(*B*) No precipitate is formed on the addition of hydrochloric acid to the original solution = brenzcatechine, hydroquinone, metol, ortol, or para-phenyl-endiamine.

Acidulate a small quantity of the original solution with hydrochloric acid, and shake with ether.

1. If a precipitate is left on evaporation of the ether = brenzcatechine, hydroquinone, ortol.

The residue gives quinone = hydroquinone or ortol. Acidulate a small quantity of the original solution with sulphuric acid, boil off the free sulphurous acid, and oxidise with potassium bichromate. If the red colour mentioned in the table appears, it is ortol; in the other case, hydroquinone.

(*b*) The residue gives quinone = brenzcatechine. Test with ferric chloride and acetate of lead.

2. If there is no marked residue on evaporation on the ether = metol or para-phenyl-endiamine. Acidulate a small quantity of the original solution with dilute sulphuric acid, boil off the free sulphurous acid, and add to the liquid cooled with ice some solution of nitrite till it smells of nitrous acid.

(*a*) If, after the addition of the nitrite, a compound separates out (nitros-metol) = metol. This is proved by no colour being formed in a caustic alkaline solution with α-naphthol-ϵ-disulphonic acid.

(*b*) The solution containing nitrite gives, when poured into a caustic alkaline solution of α-naphthol-ϵ-disulphonic acid, a red-violet colour = para-phenyl-endiamine.

In the above notes the method of analysis is given when only one developing agent is present in the secret preparation. It is rather more trouble when two or more reducing agents are present; still the data in the table will be of some assistance, and they may be tested for separately.

FORMULÆ.

WITH the view of enabling the readers of the ALMANAC to find any particular one of the following numerous Formulæ or Tables, we give below an Index to the Contents of this section of the ALMANAC, which will doubtess facilitate reference.

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ABOUT WEIGHTS AND MEASURES.

The inconveniences of the English system of weights and measures has long been felt by all who are engaged in any form of research. It is not a question of the units so much as of their divisions. If it were only a matter of English convenience, there would probably be little desire to change the pound and the yard, which are our standards, and it would only be a question of dividing them suitably. But decimal division and multiplication of these units, or their subordinate ones, is practically impossible to avoid, and no one can help feeling the advantage which would follow from universal decimalisation, at least no one who has much to do with the calculations necessary for modern science, which reduces all things to number, weight, and measure. If this decimalisation were taken in hand with our present units (standards), it would be necessary to devise new names for some subordinate units, and to make them such as would clearly distinguish them from the old system. No one surely would seriously propose to deliberately add to the confusion we already enjoy of having two ounces, three drachms, and two pounds (not to speak of the monetary unit represented by a sovereign) which are a constant source of confusion, even though some of these are not sanctioned by law. Besides, if we retain our units, we should still be under the disadvantage in our commerce of differing in our units from all our neighbours, and in our science of want of ready connexion between our units of length and weight. There have been several suggestions made for decimalising our weights; of these the best probably was that the avoirdupois pound, of 7000 grains, should be divided into 1000 parts, to be called septems, and that the measure of fluids should correspond to a pound of pure water and be divided similarly, but nothing has ever come of this. Recently, indeed, a proposal was made to adopt a new pound of 8000 grains, divided into 16 ounces of 500 grains each, thus adding to our confusion for the sole purpose of getting an ounce of a round number of grains, for it is difficult to see what other gain there would be.

If there is to be a change, then, the new system should be free from as many as possible of the disadvantages of what we have, and not be liable to require further modification. One solution only seems possible, and that is that Englishmen take the advice of, and follow the practice of, the most scientific portion of their body, and adopt the metric system in its entirety. The units are not practically inconvenient, nor are the names of them really difficult to deal with; and, if they were so, objections would come with a bad grace from photographers, whose journals teem with words of Greek and Latin derivation, awful to look at and far worse to pronounce than kilo, gramme, metre, litre, or c. c.

Whether our readers are prepared to go the whole length with us or no (and the retention of the old forms should meet the convenience of the most conservative) we think there is another convenience arising from the step now taken. It must be well known to all that the use of percentages, and even of what are called parts, has become a practice in photographic work. What the advantage of parts, as lately used, is we fail to see; but the use of percentages is a practical confession of the advantage of decimalisation. It is proposed to adopt here one uniform quantity of the solution to be made up, that is the litre of 1000 cubic centimetres, and containing 1000 grammes of pure water. The quantities of each constituent will be given in grammes or cubic centimetres (c. c.), according as it is solid or fluid, and, as a rule, fractions of a gramme will be neglected.

The English grains per ounce have been converted into grammes per litre by multiplying them by $\frac{16}{7}$, and drops per ounce into c. c. per litre by the factor $\frac{25}{12}$.

It has been suggested that the accuracy of these conversions is excessive, but it has been thought better to leave the expert to adopt more convenient figures, rather than to make the author of a formula responsible in appearance for what he did not sanction. In a few cases where the author has given his formula both in English and metric form, his equivalents have been adhered to, and it is hoped that this practice will be more general in future.

Those who prefer percentages will find their wants met if they bear in mind that one-tenth of the quantities given will make 100 c. c. of solution, and be, in fact, percentages. The gentlemen who wish to make use of parts will find that, by reading *parts* for grammes or c. c., they will have formulæ quite as accurate as those they have been in the habit of using.

In some cases there is a doubt whether the author of a formula means that the solution should be made up to the quantity directed to be made, or whether he means the amount of water specified to be added. It would be accordant with uniformity to take the latter view; in many cases it does not much matter which is taken, but, when there is a large quantity of water of crystallisation in the substance used, it may be material, and it would be very desirable if all photographers would distinctly state which mode of mixing they mean to be followed. Where sodium sulphite, for instance, is employed in crystals, no less than half the weight is water. In this common salt it is stated in the Solubility Tables that a saturated solution contains twenty-five per cent., but much stronger solutions are prescribed, in one case fifty per cent. is ordered in a standard work on our art. In this case, if 5 parts of salt (in crystals) is dissolved in hot water and the solution made up to 10 parts, we have virtually 2·5 parts of the anhydrous salt in the 10 parts, that is, a twenty-five per cent. solution, saturated at ordinary temperatures but liable to change when it is cold; but, if 10 parts of water are used to dissolve the 5 of salt, the solution will only contain twenty per cent. of anhydrous salt, and probably would always be unchanged in any workroom.

DEVELOPING FORMULÆ FOR GELATINE DRY PLATES, ETC.

The following are a few of the typical formulæ that are generally employed for development, &c.; a much greater variety will be found in the section headed 'Developing Formulæ of the Principal Plate-makers (p. 1016 *et seq.*), to which we also refer the reader.

PYRO SODA.

No. 1.	A.	Sulphite of soda	6 ounces or	188 grammes.
		Water	32 ,,	,, 1000 c. c.
		Pyrogallic acid..................	1 ounce ,,	31 grammes.

(Having dissolved the sulphite of soda, add sufficient citric acid in solution to cause a piece of blue litmus paper inserted therein to become reddened.)

	B.	Carbonate of soda	3 ounces or	94 grammes.
		Carbonate of potash	1 ounce ,,	31 ,,
		Water	32 ounces ,,	1000 c. c.

When about to develop, mix these in equal proportions with two parts the bulk of water, or, if the weather be *very* hot at the time, even a greater proportion of water.

No. 2.	A.	Sulphite of soda (crystals)...	2 ounces or	166 grammes.
		Citric acid	60 grains ,,	11 ,,
		Ammonium bromide	40 ,, ,,	8 ,,
		Pyro	1 ounce ,,	83 ,,
		Water	12 ounces ,,	1000 c. c.
	B.	Sulphite of soda (crystals)...	2 ounces or	166 grammes.
		Carbonate potassium (crys.)	3 ,, ,,	250 ,,
		Water	12 ,, ,,	1000 c. c.

To develop, use 1 drachm (or 6 c. c.) of each to 2 ounces (or 100 c. c.) of water.

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HIGHEST QUALITY.

PYRO AND AMMONIA.

No. 1.	Strong liquid ammonia	2 ounces	or	25 c. c.
	Bromide potassium	300 grains	,,	9 grammes.
	Water	80 ounces	,,	1000 c. c.
No. 2.	Pyrogallic Acid	20 grains	or	4·6 grammes.
	Water	10 ounces	,,	1000 c. c.
	Nitric acid	2 drops	,,	0·5 ,,

For use take equal parts.

FERROUS OXALATE.

No. 1.	Saturated solution of sulphate of iron	1 part.
	Saturated solution of oxalate of potash	3 parts.

Mix *quant. suff.* by pouring the iron into the oxalate. In hot weather the proportion of the iron solution may be diminished with advantage.

FOR TRANSPARENCIES ON GELATINO-CHLORIDE PLATES.

No. 2.	A.	Neutral oxalate of potash	2 ounces	or	100 grammes.
		Chloride of ammonium ...	40 grains	,,	4·5 ,,
		Distilled water...............	20 ounces	,,	1000 c. c.
	B.	Sulphate of iron	4 drachms	or	34 grammes.
		Citric acid	2 ,,	,,	17 ,,
		Alum..........................	2 ,,	,,	17 ,,
		Distilled water...............	16 ounces	,,	1000 c. c.

For black tones mix the above in equal volumes.

METOL.

SINGLE-SOLUTION DEVELOPER.

Metol	40 grains	or	11 grammes.
Sulphite of soda	120 ,,	,,	34 ,,
Hydroquinone	48 ,,	,,	14 ,,
Carbonate of potash..............	240 ,,	,,	69 ,,
Water..................................	8 ounces	,,	1000 c. c.

Apply heat if necessary to dissolve the metol, and afterwards add the sulphite, and allow that to dissolve before adding the other ingredients.

For use under normal conditions, one part of the above is to be diluted with three parts of water.

The 'WELLINGTON'
FILMS.

DAYLIGHT Cartridges, Cut SHEETS, &c.

Two-solution Developer.

A.	Metol	40 grains or	11 grammes.
	Hydroquinone	48 ,, ,,	14 ,,
	Sulphite of soda	120 ,, ,,	34 ,,
	Water	8 ounces ,,	1000 c. c.
B.	Carbonate of potash	1 ounce or	13 grammes.
	Water	1 quart ,,	1000 c. c.

For use, mix one part of A with three parts of B for ordinary exposures; for over-exposures use less of B, or else add a few drops of a ten per cent. solution of bromide of potassium, or of a five per cent. solution of citric acid; for slight under-exposure, increase B.

Three-solution Developer.

A.	Metol	40 grains or	11 grammes.
	Sulphite of soda	120 ,, ,,	34 ,,
	Water	8 ounces ,,	1000 c. c.
B.	Hydroquinone	40 grains or	11 grammes.
	Citric acid	10 ,, ,,	3 ,,
	Water	8 ounces ,,	1000 c. c.
C.	Carbonate of potash	1 ounce or	50 grammes.
	Water	20 ounces ,,	1000 c. c.

For use under similar conditions to those already mentioned, take one part each of A and B and two parts of C.

METOL-HAUFF.

Solution A.

Water	100 parts or	1000 c. c.
Metol	1 part ,,	10 grammes.
Soda sulphite	10 parts ,,	100 ,,

Solution B.

Water	100 parts or	1000 c. c.
Carbonate potash (or substitute)	10 ,, ,,	100 grammes.
Crystallised carbonate soda	20 ,, ,,	200 ,,

For use, three parts A to one of B.

— THE —

'WELLINGTON' Photographic

Papers and Films

Specially recommended FOR EXPORT.

METOL-ANDRESEN.

Water	1 quart	or 1000 c. c.
Metol	¾ ounce	,, 19 grammes.
Sulphite of soda	7 ounces	,, 175 ,,
Carbonate of potash	3½ ,,	,, 88 ,,
Bromide of potassium	$\frac{1}{10}$ ounce	,, 2·5 ,,

For use, take one part of developer to three of water.

To photographers who prefer to work with separate solutions the following is recommended:—

A.	Water	1 quart	or 1000 c. c.
	Metol	¾ ounce	,, 19 grammes.
	Sulphite of soda	7 ounces	,, 175 ,,
B.	Water	3 quarts	or 1000 c. c.
	Carbonate of soda	7 ounces	,, 58 grammes.

One part of A is mixed with three parts of water for use, bromide of potassium being added as required for the prevention of fogging.

ANDRESEN'S GLYCIN.

I. For soft development:

Solution A (warm slightly).

Glycin	4 parts	or 40 grammes.
Carbonate of potash	1½ ,,	,, 15 ,,
Sulphite of soda (cryst.)	12 ,,	,, 120 ,,
Water	100 ,,	,, 1000 c. c.

Solution B.

Carbonate of potash	10 parts	or 100 grammes.
Water	100 ,,	,, 1000 c. c.

For use mix one part of *A* with two parts of *B*.

II. For hard development:

Glycin	5 parts	or 50 grammes.
Carbonate of potash	25 ,,	,, 250 ,,
Sulphite of soda (cryst.)	25 ,,	,, 250 ,,
Water	100 ,,	,, 1000 c. c.

For use to be diluted three times its volume.

The 'WELLINGTON'
ENAMMO Glazed Surface Bromide.
ROSE, WHITE, and MAUVE.

GLYCIN-HAUFF.

The concentrated developer is made up as follows:—350 grains (80 grammes) of sodium sulphite crystal are dissolved by heat in one ounce (100 c. c.) of water, 150 grains (35 grammes) of glycin are then added and the mixture is to be heated to boiling point, and one and a half ounces (150 grammes) of potash carbonate are added (begin adding the potash in small quantities, on account of the carbonic acid gas). When cold, this concentrated developer—forming a thin, pasty solution—may be kept as stock. For use, shake the solution first, and dilute the required quantity twelve times for ordinary purposes. For use when development is to be left to itself, the stock solution is diluted fifty times.

A One-solution Formula.

Sodium sulphite	40 grains	or	23 grammes.
Glycin	20 ,,	,,	11 ,,
Potassium carbonate	80 ,,	,,	46 ,,
Water	4 ounces	,,	1000 c. c.

PARA-AMIDOPHENOL.

Para-amidophenol chlorhydrate	5 grammes.
Crystallised carbonate of sodium	50 ,,
Crystallised sulphite of sodium	50 ,,
Water	1000 ,,

For use, dilute with an equal bulk of water.

Para-amidophenol hydrochlorate	60 grains	or	7 grammes.
Sodium sulphite	60 ,,	,,	7 ,,
,, carbonate	400 ,,	,,	46 ,,
Water	20 ounces	,,	1000 c. c.

Dr. Andresen's Formula.

Para-amidophenol chlorhydrate	8 parts or grammes.
Sodium sulphite	80 ,, ,, ,,
,, carbonate	40 ,, ,, ,,
Water	1000 ,, ,, c. c.

The 'WELLINGTON'

Pink, Mauve,
White, and Matt.
P. O. P.

'ORDINARY,' for the Phosphate and Formate Toning Baths.

AMIDOL.

Amidol	80 grains	or	23 grammes.
Sodium sulphite	800 ,,	,,	230 ,,
Water	8 ounces	,,	1000 c. c.

For use, one ounce of the solution is diluted with three ounces of water, with one and a half grains of potassium bromide to the ounce of developer.

EIKONOGEN.

No. 1.	A.	Crystalline sulphite of soda	40 grammes.
		Eikonogen	3 ,,
		Distilled water	500 c. c.
	B.	Carbonate of potash (or calcined soda)	60 to 75 grammes.
		Distilled water	500 c. c.

For use, mix equal volumes of A and B.

ONE-SOLUTION DEVELOPER.

Sulphite of soda in crystals	8 ounces	or	100 grammes.
Carbonate of soda in crystals	3 ,,	,,	38 ,,
Distilled water	80 ,,	,,	1000 c. c.
Eikonogen	1 ounce	,,	13 grammes.

HYDROQUINONE.

No. 1.		Hydroquinone	1 part	or	15 grammes.
		Sulphite of soda	2 parts	,,	30 ,,
		Carbonate of soda	10 ,,	,,	150 ,,
		Water	67 ,,	,,	1000 c. c.
No. 2.	A.	Hydroquinone	4 grains	or	9 grammes.
		Metabisulphite of potash	4 ,,	,,	9 ,,
		Bromide of potassium	1 grain	,,	23 ,,
		Distilled water	1 ounce	,,	1000 c. c.
	B.	Potassium hydrate	10 grains	or	23 grammes.
		Distilled water	1 ounce	,,	1000 c. c.

Equal parts of A and B.

With some plates the bromide may be omitted.

The 'WELLINGTON'

Pink, Mauve,
White, and Matt.

P. O. P.

'ORDINARY,' for the Phosphate and Formate Toning Baths.

No. 3.	A.	Hydroquinone	80 grains	or	9 grammes.
		Citric acid	10 ,,	,,	1·4 ,,
		Sulphite of soda (recrystal.)	80 ,,	,,	9 ,,
		Distilled water	20 ounces	,,	1000 c. c.
	B.	Caustic potash (fused)	160 grains	or	18 grammes.
		Sulphite of soda	160 ,,	,,	18 ,,
		Distilled water...	20 ounces	,,	1000 c. c.
	C.	Bromide of potassium	24 grains	or	55 grammes.
		Distilled water	1 ounce	,,	1000 c c.
	D.	Caustic potash	160 grains	or	18 grammes.
		Distilled water	20 ounces	,,	1000 c. c.

For normal exposures use equal parts of A and B, adding five minims of C for every ounce of solution, or one per cent. of C.

For over-exposed plates use D instead of B, with an extra quantity of C.

For under-exposed plates omit C, and in extreme cases add six or eight grains more of sulphite of soda to each ounce of the developer. The object of increasing or decreasing the quantity of sulphite is to give greater or lesser density.

No. 4.	A.	Hydroquinone	160 grains	or	18 grammes.
		Sulphite of soda	2 ounces	,,	100 ,,
		Citric acid	60 grains	,,	7 ,,
		Bromide of ammonium ...	20 ,,	,,	2 ,,
		Water to........................	20 ounces	,,	1000 c. c.
	B.	Carbonate of potash.........	2 ounces	or	100 grammes.
		Carbonate of soda (crystal)	2 ,,	,,	100 ,,
		Water to........................	20 ,,	,,	1000 c. c.

Take equal parts.

No. 5.	A.	Hydroquinone	15 grains	or	7 grammes.
		Sulphite of soda	75 ,,	,,	35 ,,
		Water	5 ounces	,,	1000 c. c.
	B.	Carbonate of potash.........	90 grains	or	41 grammes.
		Water	5 ounces	,,	1000 c. c.

C. Ten per cent. solution of bromide of potassium.

Use equal parts of A and B, and add two or three minims of C. With some plates no bromide restrainer will be required.

The 'WELLINGTON'

Gives a SUPERB
Variety of Tones.

P. O. P.

'SPECIAL,' for the Sulphocyanide Bath.

No 6.	Sulphite of soda	40 grammes.
	Hydroquinone	5 ,,
	Carbonate of soda	75 ,,
	Water	200 c.c.

For use, dilute ten c.c. with water to thirty-five c.c.

For a single stock solution prepare as follows :—

No. 7.	A.	Hydroquinone	50 grains	or	29 grammes.
		Metabisulphite of potash	80 ,,	,,	46 ,,
		Water	4 ounces	,,	1000 c. c.
	B.	Carbonate of potash	840 grains	or	480 grammes.
		Water	4 ounces	,,	1000 c.c.

Filter solution B, and then mix A and B.

For use, take half an ounce of this solution and add to five ounces of water.

For Chloride Plates.

Hydroquinone	2 grains	or	4·5 grammes.
Sulphite of soda	10 ,,	,,	23 ,,
Carbonate of ammonia (or pot.)	10 ,,	,,	23 ,,
Bromide of potassium	$\frac{1}{10}$ grain	,,	0·3 ,,
Water	1 ounce	,,	1000 c. c.

DIPHENAL.

Diphenal, one of the recently introduced new developers, is chemically di-amido-oxydiphenyl, and it is the production of the Actien-Gesellschaft für Anilin-fabrikation, of Berlin. It is sent out in the form of a readily prepared solution of a brown colour, and the following are the directions for its use. For correctly exposed plates take :—

Diphenal	1 part.
Water	15 to 20 parts.

For over-exposed plates—

Diphenal	1 part.
Water	8 to 10 parts.

and for under-exposed plates take—

Diphenal	1 part.
Water	20 to 25 parts.

THE 'WELLINGTON'

Platino-Matt Bromide.

Smooth, Rough, Tinted Rough, &c.

ACETONE PYRO-DEVELOPER.

Messrs. Lumière, who introduced acetone as a substitute for alkali in the pyro developer, recommend the following composition as the best for a normal developer:—

Water	100 parts.
Sulphite of sodium (anhydrous)	5 ,,
Acetone solution	10 ,,
Pyrogallic acid	1 part.

ORTOL.

1. Ortol Soda.

A.	Water, cold	10 ounces	or	1000	c. c.
	Metabisulphite of potash	35 grains	,,	7·5	grammes.
	Ortol	70 ,,	,,	15	,,
B.	Water	10 ounces	or	1000	c. c.
	Carbonate of soda, crystals	1¼ ,,	,,	120	grammes.
	Sulphite of sodium, crystals	1¾ ,,	,,	180	,,
	Bromide of potassium	5—10 grains	,,	1—2	,,
	Hypo solution, 5 : 100	50 minims	,,	10	c. c.

2. Ortol Potash.

A.	Water, cold	10 ounces	or	1000	c. c.
	Metabisulphite of potash	35 grains	,,	7·5	grammes.
	Ortol	70 ,,	,,	15	,,
B.	Water	10 ounces	or	1000	c. c.
	Carbonate of potash	½ ounce	,,	60	grammes.
	Sulphite of sodium, crystals	1¾ ounces	,,	180	,,
	Bromide of potassium	5—10 grains	,,	1—2	,,
	Hypo solution 5 : 100	50 minims	,,	10	c. c.

In cold weather the bromide of potassium may be left out.
For quick development take 1 part A and 1 part B.
For slow and soft development take 1 part A, 1 part B, 1 part water.

THE 'WELLINGTON'
Platino = Matt Bromide
For Enlargements.

ADUROL.

I.—Separate Developer.

A.	Adurol	10 grammes	or 85 grains.
	Sulphite of sodium (cryst.)	80 ,,	,, 1¾ ounces.
	Water	500 c. c.	,, 10 ,,
B.	Carbonate of potash	60 grammes	or 1¼ ounces.
	Water	500 c. c.	,, 10 ,,

For studio work and snap-shots take 1 part of A, 1 part of B.

For time exposures outdoor take 1 part of A, 1 part of B, 1 part of water.

II.—One-solution (Concentrated) Developer.

Sulphite of sodium (cryst.)	200 grammes	or 4 ounces.
Carbonate of potash	150 ,,	,, 3 ,,
Water	500 c. c.	,, 10 ,,

After all having been dissolved,

Adurol	25 grammes	or ½ ounce.

For studio work and snap-shots take 1 part with 3 parts of water.
For time exposures outdoor take 1 part with 5 parts of water.

KACHIN.

A Single solution Developer.

Water	200 grammes.
Sulphite of soda	5 ,,
Carbonate of soda (crystals)	10 ,,
Kachin	2 ,,

A Two-solution Developer.

A.	Water	250 grammes.
	Sulphite of soda	25 ,,
	Kachin	5 ,,
B.	Water	250 grammes.
	Caustic soda (pure sticks)	5 ,,
	Phosphate of soda	47 ,,

For use, mix 1 part of A with 1 part of B and 1 part of water.

The 'WELLINGTON'
FILMS.
For all Cameras, SHEATHS, &c.

DEVELOPING FORMULÆ, ETC., OF THE PRINCIPAL PLATE AND PAPER MAKERS.

AUSTIN EDWARDS'S FORMULÆ.

Pyro.

No. 1.	Pyrogallic acid	1 ounce or	12 5 grammes.
	Nitric acid	20 drops ,,	0·5 c. c.
	Water	80 ounces ,,	1000 ,,
No. 2.	Sulphite of soda	10 ounces or	125 grammes.
	Carbonate of soda (crystals)	9 ,, ,,	113 ,,
	Water	80 ,, ,,	1000 c. c.

Add the acid to the water before dissolving the pyro.

For correct exposure, use equal parts of Nos. 1 and 2.

For under-exposure, use more No. 2.

For over-exposure use more No. 1, or add a few drops of per ounce 10 per cent. bromide potassium solution.

For correct exposure, no bromide is necessary.

Hydroquinone.

No. 1.	Water	20 ounces or	1000 c. c.
	Hydroquinone	120 grains ,,	14 grammes.
	Sulphite soda	2 ounces ,,	100 ,,
No. 2.	Water	20 ounces or	1000 c. c.
	Carbonate of potash	4 ,, ,,	200 grammes.
	Bromide potassium	30 grains ,,	3·5 ,,

Dissolve the hydroquinone in the water before adding the sulphite. For use take equal parts of each.

Hydroquinone Developer for Lantern Plates.

(For Black Tones.)

Distilled water	20 ounces or	1000 c. c.
Hydroquinone	60 grains ,,	7 grammes.
Sulphite soda	2 ounces ,,	100 ,,
Carbonate soda (crystals)	6 ,, ,,	300 ,,
Bromide potassium	40 grains ,,	4·6 ,,

— THE —

'WELLINGTON' Photographic

Papers and Films

Give SUPERB RESULTS.

Dissolve the hydroquinone in the water and add the other ingredients in the order named.

Time of development, if exposed correctly, about 2 minutes. This developer may be used several times.

PYRO DEVELOPER.
(For Warm Tones.)

No. 1.	Water	20 ounces	or	1000 c. c.
	Nitric acid	20 drops	,,	2 ,,
	Sulphite soda	4 ounces	,,	200 grammes.
	Pyrogallic acid	1 ounce	,,	50 ,,
No. 2.	Water	20 ounces	or	1000 c. c.
	Bromide ammonium (not potass.)	3 ,,	,,	150 grammes.
	Liq. ammonia ·880	1 ounce	,,	50 ,,

Add the acid to the water, and the other ingredients in the order named.

For use, take 1 part each of Nos. 1 and 2, and dilute with equal quantities of water. For still warmer tones, add 1 part more water, or again double the exposure and add one-fourth more No. 2. This developer may be used several times.

CADETT & NEALL'S FORMULÆ.

PYRO AMMONIA (1).

Stock Solution.

Pyrogallic acid	(avoirdupois)	1 ounce	or	136 grammes.
Ammonium bromide	,,	½ ,,	,,	68 ,,
Potass. metabisulphite	,,	1 ,,	,,	136 ,,

Distilled water to make altogether, 7 ounces, 3 drachms, fluid or 1000 c. c.

Dissolve the metabisulphite and bromide in part of the distilled water before adding the pyrogallic acid.

A.	Stock solution	1 ounce	or	50 c. c.
	Distilled water to make altogether	20 ounces = 1 pint	,,	1000 ,,
B.	Ammonia (·890)	2½ drachms	or	16 c. c.
	Distilled water to make altogether	20 ounces = 1 pint	,,	1000 ,,

Mix equal parts of A and B to make developer.

WELLINGTON & WARD,

ELSTREE, HERTS.

Manufacturers of { Platino-Matt Bromide, P.O.P., Films, &c.

PYRO AMMONIA (2).

Stock Solution.

Pyrogallic acid......... (avoirdupois)	1 ounce	or 136 grammes.
Ammonium bromide... ,,	1 ,,	,, 136 ,,
Sulphurous or sulphuric or citric acid,	1 drachm,,	17 c. c. or grammes.

Distilled water to make altogether, 7 ounces, 3 drachms, fluid or 1000 c. c.

Mix the acid with part of the distilled water before adding the bromide and pyrogallic acid.

A.	Stock solution	1 ounce	or	50 c. c.
	Distilled water to make altogether	20 ounces=1 pint	,,	1000 ,,
B.	Liq. ammoniæ (·890)	2½ drachms	or	16 c. c.
	Distilled water to make altogether	20 ounces=1 pint	,,	1000 ,,

Mix equal parts of A and B to make developer.

FERROUS OXALATE.

A.	Ferrous sulphate .... (avoirdupois)	5 ounces	or	250 grammes.
	Sulphuric acid	10 minims	,,	1 c. c.
	Distilled water to make altogether	20 ounces	or	1000 c. c.
B.	Neutral potass. oxalate ......(avoirdupois)	10 ounces	or	250 grammes.
	Distilled water to make altogether (fluid)	40 ,,	,,	1000 c. c.

Dissolve the potass. oxalate in about three-quarters of the distilled water, made warm, and make up to bulk after the salt is dissolved.

The ferrous sulphate should be powdered just before solution in about three-quarters of the distilled water to which the sulphuric acid has been previously added. Make up to bulk after solution.

To make developer, add one part of A to four of B. For over-exposure, add a few drops to the mixed developer of a ten per cent. solution of potassium bromide.

PYRO SODA.

Stock Solution.

Pyrogallic acid .... (avoirdupois)	1 ounce	or	100 grammes.
{ Potassium metabisulphite	40 grains	,,	9 ,,
{ or sulphuric acid .... (fluid)	1 drachm	,,	12 c. c.
Distilled water to make altogether ,,	10 ounces	,,	1000 ,,

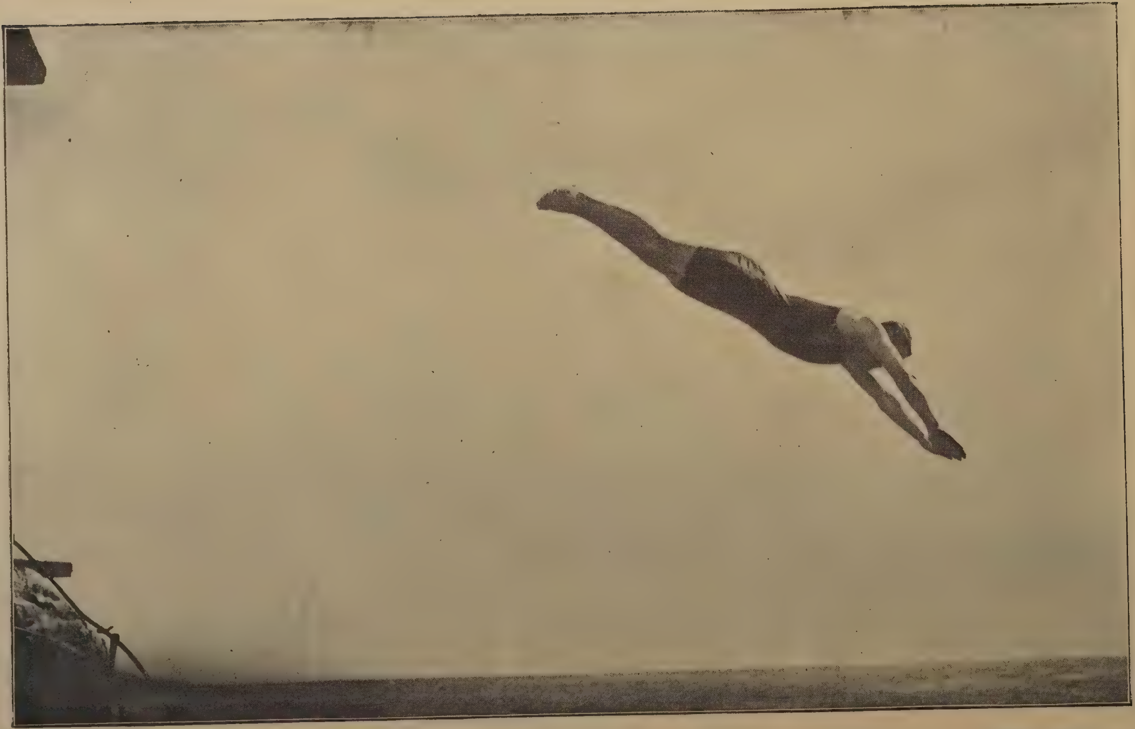
The 'WELLINGTON' BRAND

Is a Guarantee of the

HIGHEST QUALITY.

Geddies, Photo.

Taken with a **Half**-plate **Goerz Anschutz Folding Camera.**
(See pages 378-379.)



Kilbey, Photo.

Taken in $\frac{1}{1000}$ second (not enlarged) with **Goerz Anschutz Folding Camera.** (See pages 378-379).
This picture took the First Prize in the Warwick Plate Competition.

A.	Stock solution .... (fluid)	3	ounces	or	150	c. c.
	Distilled water to make altogether ,,	20	,,	,,	1000	,;

B.	{ Sodium carbonate (crystals) (avoird.)	11	ounces	or	138	grammes.
	} or ditto ditto (anhydrous) ,,	4	,,	,,	50	,,
	Sodium sulphite (recrystd.) ,,	15	,,	,,	188	,,
	Distilled water to make altogether ,,	80	,,	,,	1000	c. c.

Equal parts of each to make developer.

A few drops of a ten per cent. solution of potassium bromide may be added to the developer when necessary. In very hot weather the hypo bath should not be stronger than 1lb. of sodium hyposulphite to 2 quarts of water or twenty per cent.

DEVELOPERS FOR THE 'CADETT' LANTERN PLATES.

Warm Tones.—Pyro Ammonia.

A.	Pyrogallic acid	40	grains	or	5	grammes.
	Ammonium bromide	40	,,	,,	5	,,
	Potass metabisulphite	120	,,	,,	14	,,
	Distilled water to make altogether (fluid)	20	ounces	,,	1000	c. c.

B.	Liq. ammoniæ	150	minims	or	16	c. c.
	Distilled water to make altogether (fluid)	20	ounces	,,	1000	,,

Equal parts of A and B to make developer.

This formula gives rich warm tones with suitable exposure.

For warm black tones, the following may be used :—

A.	Pyrogallic acid..............................	30	grains	or	3·5	grammes.
	Sodium sulphite	100	,,	,,	11	,,
	Sulphurous acid (or citric acid 5 grains)	5	minims	,,	0·5	c. c.
	Ammonium bromide	30	grains	,,	3·5	grammes.
	Distilled water to make altogether ...	20	ounces	,,	1000	c. c.

B.	Liq. ammoniæ ·890	40	minims	or	4	c. c.
	Distilled water to make altogether (fluid)	20	ounces	,,	1000	

Equal parts of A and B to make developer.

The 'WELLINGTON'

ENAMMO Glazed Surface Bromide.

For Contact or Enlargements.

A rich warm black can be obtained with hydroquinone, and we strongly recommend the following formula:—

A.	Hydroquinone	70 grains	or	8 grammes.
	{ Potass metabisulphite	10 ,,	,,	1 ,,
	{ or sulphurous acid.........................	15 minims	,,	1·5 c c.
	Potassium bromide	35 grains	,,	4 grammes.
	Distilled water to make altogether (fluid)	20 ounces	,,	1000 c. c.
B.	Potassium hydrate (sticks)	140 grains	or	16 grammes.
	Sodium sulphite	700 ,,	,,	80 ,,
	Distilled water to make altogether	20 ounces	,,	1000 c. c.

Equal parts of A and B to make developer.

Black Tones.

Cold, but brilliant black tones are obtained with ferrous oxalate, adding a sufficient quantity of a 10 per cent. solution of potassium bromide to prevent too rapid development.

A.	Ferrous sulphate .... (avoirdupois)	5 ounces	or	250 grammes.
	Sulphuric acid	10 minims	,,	1 c. c.
	Distil. water to make altogether (avoird.)	20 ounces	,,	1000 ,,
B.	Neutral potass oxalate...... (avoirdupois)	10 ounces	,,	250 grammes.
	Distilled water to make altogether (fluid)	40 ,,	,,	1000 c. c.

Dissolve the potass oxalate in about ¾ of the distilled water, made warm, and make up to bulk after the salt is dissolved.

The ferrous sulphate should be powdered just before solution in about ¾ of the distilled water to which the sulphuric acid has been previously added. Make up to bulk after solution.

To make developer, add 1 part of A to 4 of B. For over-exposure add a few drops to the mixed developer of a 10 per cent. solution of potassium bromide.

THE KODAK COMPANY'S FORMULÆ.

For Bromide Paper.

No. 1.	Oxalate of potash...............	16 ounces	or	333 grammes.
	Hot water	48 ,,	,,	1000 c c.

— THE —
'WELLINGTON' Photographic
Papers and Films
Specially recommended FOR EXPORT.

No. 2.	Proto-sulphate of iron	16 ounces	or 500 grammes.
	Hot water	32 ,,	,, 1000 c. c.
	Acetic acid	½ drachm	,, 2 ,,
	or,		
	Citric acid	½ ounce	,, 16 grammes.
No. 3.	Bromide of potassium	1 drachm	or 14 grammes.
	Water	10 ounces	,, 1000 c. c.

These solutions must be cooled and kept separately, and should be mixed only for immediate use.

To develop, take in a suitable tray, No. 1, 6 ounces, or 120 c. c., No. 2, 1 ounce, or 20 c c.; No. 3, ½ drachm, or 1 c. c. Mix in the order given; use cold. After exposure, soak the paper in water until limp; then immerse in the developer. The image should appear slowly, and should develop up strong, clear, and brilliant. When the shadows are sufficiently black, pour off the developer and flood the plate with the

Clearing Solution.

Acetic acid	1 drachm	or 4 c. c.
Water	32 ounces	,, 1000 ,,

After fixing, wash thoroughly two hours, and hang up to dry. Use fresh developer for each batch of prints. With a glass-bottomed tray, eight ounces of developer are sufficient for a 25 × 30 print.

FOR KODAK FILMS.

No. 1.	Sulphite of soda	6 ounces	or 188 grammes.
	Hot water	32 ,,	,, 1000 c. c.
	When cold, add—		
	Pyrogallic acid	1 ounce	or 31 grammes.
No. 2.	Carbonate of soda	3 ounces	or 94 grammes.
	Carbonate of potash	1 ounce	,, 31 ,,
	Water	32 ounces	,, 1000 c. c.

To develop, take, for normal exposures, one part each of No. 1 and No. 2, together with two parts of water.

Restrainer.

Bromide of potassium	1 ounce	or 167 grammes.
Water	6 ounces	,, 1000 c. c.

The 'WELLINGTON'

ENAMMO Glazed Surface Bromide.

ROSE, WHITE, and MAUVE.

If a number of films are fixed together in one tray, they should be put in *face down*, to avoid abrasion of the sensitive surface. It is well to move them about in the fixing bath, from time to time, in order to remove any air bubbles. After fixing, *wash thoroughly;* then immerse for one minute in the

Soaking Solution.

Water	16 ounces	or 1000 c c.
Glycerine	½ ounce	,, 31 ,,

Remove from the soaking solution, and pin up each film by *one* of its corners, to dry spontaneously. Any tear drops of the soaking solution should be removed with a bit of blotting-paper or absorbent cotton.

EDWARDS'S FORMULÆ.

Pyro and Ammonia Developer.

No. 1.	Pyrogallic acid	1 ounce	or 30 grammes.
	Citric acid	40 grains	,, 3 ,,
	Water	7½ ounces	,, 214 c. c.
No. 2.	Strong ammonia ·880	1 ounce	or 28 c. c.
	Bromide of potassium	120 grains	,, 8 grammes.
	Distilled water	7 ounces	,, 200 c. c.

The above will keep good for months, if well corked.

For use, dilute 1 part No. 1 with 19 parts of water, and in another bottle 1 part No. 2 with 19 parts of water. The dilute solutions should be made fresh every day.

To develop a correctly exposed plate or film mix equal parts of these two solutions.

Pyro and Soda Developer.

No. 1.	Pyrogallic acid	1 ounce	or 30 grammes.
	Nitric acid	20 drops	,, 1 c. c.
	Water	80 ounces	,, 2 litres 300 c. c.
No. 2.	Sulphite of soda	10 ounces	or 300 grammes.
	Carbonate of soda (washing soda)	8 ,,	,, 226 ,,
	Water	80 ,,	,, 2 litres 300 c. c.
No. 3.	Bromide of potassium	1 ounce	or 30 grammes.
	Water	9 ounces	,, 250 c. c.

The 'WELLINGTON'
P. O. P.
'SPECIAL,' for the Sulphocyanide Bath.
Mauve Colour only.

To develop, mix equal parts of Nos. 1 and 2, and add 10 minims of No. 3 to each ounce of the mixed developer, or, instead, 3 ounces of No. 3 may be added to the 80 ounces of No. 2. For rapid shutter exposures, omit the bromide.

PYRO AND SODA DEVELOPER WITH METABISULPHITE.

No. 1.	Pyrogallic acid	1 ounce	or 30 grammes.
	Metabisulphite of soda (Boake's)	1 ,,	,, 30 ,,
	Water	80 ounces	,, 2 litres 300 c. c.

Dissolve the metabisulphite, and then add the pyro.

No. 2.	Carbonate of soda (washing soda)	12 ounces	or 360 grammes.
	Sulphite of soda	4 ,,	,, 120 ,,
	Water	80 ,,	,, 2 litres 300 c. c.
No. 3.	Bromide of potassium	1 ounce	or 30 grammes.
	Water	9 ounces	,, 250 c. c.

To develop, mix equal parts of Nos. 1 and 2. When working in the summer time in a good light, with full exposure, add 5 minims of No. 3 to each ounce of developer (or to save the trouble of measuring small quantities, 1½ ounces of No. 3 may be added to the 80 ounces of No. 2). In winter the bromide may generally be omitted, and also for rapid shutter exposures, and portrait work in the studio.

HYDROQUINONE DEVELOPER.

No. 1.	Hydroquinone	¼ ounce	or 7 grammes.
	Sulphite of soda	1 ,,	,, 30 ,,
	Bromide of potassium	7 grains	,, ½ gramme.
	Distilled boiling water to make	12 ounces	,, 340 c. c.
No. 2.	Carbonate of potash	½ ounce	or 15 grammes.
	Distilled water to make	12 ounces	,, 340 c. c.

First dissolve the hydroquinone, and then add the sulphite and bromide.

For use mix equal parts of Nos. 1 and 2.

In case of slight over-exposure add a few drops or minims of a 10 per cent. solution of bromide of potassium to each ounce of developer, more or less according to the extent of over-exposure. For considerable over-exposure use the redeveloper.

The 'WELLINGTON'

P. O. P.

Gives a *SUPERB* variety of Tones.

For under-exposure, pour off the hydroquinone developer and finish development with the eikonogen developer given below.

EIKONOGEN DEVELOPER.

Eikonogen	½ ounce	or	14 grammes.
Carbonate of potash	1 ,,	,,	30 ,,
Sulphite of soda	2 ounces	,,	60 ,,
Distilled boiling water	20 ,,	,,	600 c. c.

First dissolve the eikonogen, then the sulphite, and lastly the carbonate of potash.

Instead of mixing the developers, the development may be commenced with eikonogen, and, when the detail is sufficiently out, hydroquinone substituted for it, without waiting to wash the negative, and the development finished with this, or in case of much over-exposure with the following hydroquinone redeveloper :—

HYDROQUINONE REDEVELOPER.

No. 1.	Hydroquinone	¼ ounce	or	7 grammes.
	Sulphite of soda	2 ounces	,,	60 ,,
	Bromide of potassium	¼ ounce	,,	7 ,,
	Distilled boiling water to make	12 ounces	,	340 c. c.
No. 2.	Carbonate of soda (washing soda)	2 ounces	or	60 grammes.
	Sulphite of soda	2 ,,	,,	60 ,,
	Distilled water to make	12 ,,	,,	340 c. c.

For use mix equal parts of Nos. 1 and 2.

EDWARDS'S GELATINO-CHLORIDE PLATES.

Development.

Make two stock solutions as follows :—

No. 1.	Neutral oxalate of potash	2 ounces	or	100 grammes.
	Chloride of ammonium	40 grains	,,	5 ,,
	Distilled water	20 ounces	,,	1000 c. c.
No. 2.	Sulphate of iron	4 drachms	or	25 grammes.
	Citric acid	2 ,,	,,	12·5
	Alum	2 ,,	,,	12·5
	Distilled water	20 ounces	,,	1000 c. c.

The 'WELLINGTON'

Pink, Mauve,
White, and Matt.

P. O. P.

'ORDINARY,' for the Phosphate and Formate Toning Baths.

The above solutions will keep indefinitely.

When required for use, mix equal portions of the above solutions, adding No. 2 to No. 1, to form the developer.

EDWARDS'S SPECIAL TRANSPARENCY PLATES.

Pyro and Ammonia Developer.

(For Warm Tones)

No. 1.	Pyrogallic acid	1 ounce	or	30 grammes.
	Sulphite of soda	4 ounces	,,	120 ,,
	Citric acid	¼ ounce	,,	8 ,,
	Water to make	16 ounces	,,	460 c. c.

First dissolve the sulphite and citric acid, and then add the pyrogallic.

No. 2.	Bromide of ammonium	1 ounce	or	30 grammes.
	Liq. ammoniæ ·880	5½ drachms	,,	20 c. c.
	Water to make	16 ounces	,,	460 c. c.

For use, mix 1 part of No. 1 and 3 parts of No. 2, and dilute with water to double the quantity.

Hydroquinone Developer.

(For Black Tones)

Hydroquinone	60 grains	or	3 grammes.
Sulphite of soda	2 ounces	,,	45 ,,
Carbonate of soda (crystals)	4 ,,	,,	90 ,,
Carbonate of potash	2 ,,	,,	45 ,,
Bromide of potassium	40 grains	,,	2 ,,
Hot distilled water	20 ounces	,,	450 c. c.

For black and white line subjects add 1 drachm of a 60-grain solution of bromide of potassium to each ounce of developer.

Dissolve the hydroquinone in the water, and add the other ingredients in the order named.

Amidol Developer.

(For Black Tones.)

Amidol	80 grains	or	5 grammes.
Soda sulphite	2 ounces	,,	60 ,,
Bromide of potassium	½ ounce	,,	15 ,,
Water	12 ounces	,,	360 c. c.

THE 'WELLINGTON'

Platino-Matt Bromide.

Smooth, Rough, Tinted Rough, &c.

ELLIOTT & SONS' FORMULÆ.

THE 'BARNET' PLATES, ORDINARY.

No. 1.	Ammonia (·880)	1½ ounce	or	75 c. c.
	Water	20 ounces	,,	1000 ,,
No. 2.	Pyrogallic acid	160 grains	or	18 grammes.
	Bromide of ammonium	¾ ounce	,,	38 ,,
	Water	20 ounces	,,	1000 c. c.
	Pure nitric acid	10 drops	,,	1 ,,

For use, mix ½ an ounce of No. 1, ½ an ounce of No, 2 with 3 ounces of water.

Pyro and Ammonia (10 *per cent. Solutions*).

No. 1.	Ammonia (·880)	1 ounce	or	100 c. c.
	Water	9 ounces	,,	900 ,,
No. 2.	Bromide of ammonium	1 ounce	or	100 grammes.
	Water, to make	10 ounces	,,	1000 c. c.
No. 3.	Pyro	1 ounce	or	100 grammes.
	Water, to make	10 ounces	,,	1000 c. c.
	Nitric acid, pure	20 drops	,,	4 ,,

For studio use, take 80 minims (10 c. c.) No. 1, 40 minims (5 c. c. No. 2, 20 minims (2½ c. c.) No. 3, and make up to 2 ounces (120 c. c.) with water.

The above developer is the same strength as that recommended on the boxes.

For outdoor work, take 80 minims No. 1, 60 minims No. 2, 40 minims No. 3, and make up to 2 ounces with water.

Pyro and Soda Developer.

Solution No. 1.

Pyro	1 ounce	or	12 grammes.
Water	86 ounces	,,	1000 c. c.
Nitric acid, pure	20 drops	,,	0 5 ,,

Solution No. 2.

Pure sulphite soda	10 ounces	or	116 grammes.
Pure carbonate soda (crystals)	9 ,,	,,	105 ,,
Water	86 ,,	,,	1000 c. c.

THE 'WELLINGTON'
Platino = Matt Bromide
For Enlargements.

Use equal parts of Nos. 1 and 2, and dilute with equal bulk of water. To each ounce add 1 or 2 drops of a ten per cent. solution of bromide of potassium.

'BARNET' LANTERN TRANSPARENCY PLATES.

For Cold or Warm Tones (according to exposure and development).

INSTRUCTIONS FOR USE.

Contact Printing.—For black tones the exposure required is about 10 seconds at a distance of 1 foot from an ordinary gas flame: the developer to be used is either No. 1 or 2.

To secure warm tones it is necessary to increase the exposure to 2 or 3 minutes and use formula either No. 3 or 4.

To obtain still warmer (reddish) tones, increase the exposure still further to 5 or 6 minutes and develop with formula No 5.

Reductions in the Camera.—For black tones with stop *f*-16 in bright diffused light from a half-plate negative an exposure of about 10 seconds is required, using formula No 1 or 2 for developing.

For warm tones increase the exposure to 2 or 3 minutes and using for developer either formula No. 3 or 4.

For still warmer tones further increase the exposure to 5 or 6 minutes and develop with formula No. 5.

FORMULÆ FOR DEVELOPERS.

Note.—In cold weather all solutions should be raised to a temperature of 60°.

Cold Black Tones.

A.

No. 1.	Metol	400	grains	or	11	grammes.
	Soda sulphite	8	ounces	,,	100	,,
	Water	80	,,	,,	1000	c. c.

B.

Carbonate of potash	1200	grains	or	34	grammes.
Ammonium bromide	240	,,	,,	7	,,
Potassium bromide	480	,,	,,	14	,,
Water	80	ounces	,,	1000	,,

Take equal parts of A and B.

THE 'WELLINGTON'

Platino-Matt Bromide

For Portraiture.

Note.—The ammonium bromide is necessary for the production of absolutely cold black tones; a larger quantity is not recommended, as it tends to produce a slight veil in the high lights.

Length of time in developing about 2 minutes.

Warm Black Tones.

A.

No. 2. Hydroquinone	640 grains	or	18 grammes.
Soda sulphite	8 ounces	,,	100 ,,
Potass bromide	120 grains	,,	3 ,,
Water	80 ounces	,,	1000 c. c.

B.

Sodium hydrate	640 grains	or	18 grammes.
Water	80 ounces	,,	1000 c. c.

Take equal parts of A and B.

This produces a very pleasing warm black. Length of time in developing about 2 minutes.

Warm Brown Tones.

A.

No. 3. Pyro	1 ounce	or	12·5 grammes.
Soda sulphite	4 ounces	,,	50 ,,
Water	80 ,,	,,	1000 c. c.

B.

Carbonate of ammonia	900 grains	or	26 grammes.
Potassium hydrate	750 ,,	,,	21 ,,
Ammonium bromide	600 ,,	,,	17 ,,
Water	80 ounces	,,	1000 c. c.

Take equal parts of A and B.

Length of time in developing about 2 minutes.

Or the following may be used:—

No. 4.—Take equal parts of No. 2 formula and add to each ounce (100 c. c.) 3 grains (·6 gramme) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 3 or 4 minutes.

— THE —
'WELLINGTON' Photographic
Papers and Films
Give **SUPERB RESULTS.**

Very Warm (Reddish) Tones.

No. 5.—Take equal parts of No. 2 formula and add to each ounce (100 c. c.) 6 grains (1·2 gramme) each of carbonate of ammonia and ammonium bromide.

Length of time in developing about 8 minutes.

Fixing Bath.

We recommend the bath not to be made stronger than

Hypo	5 ounces	or	250 grammes.
Water	20 ,,	,,	1000 c. c.

Clearing solutions will not be found necessary with these plates.

BARNET BROMIDE PAPER.

(Extra Rapid.)

Platino Matt Surface.—Directions for Working.

Exposure.—For contact work from an average negative about 4 seconds, 18 inches from an ordinary gas burner.

For enlarging it is impossible to give any fixed data, so much depending upon the source of light. It is recommended to make a trial exposure upon a small piece of paper.

After exposure place the print, sensitive side upwards, in a clean developing dish, flood with water for a few seconds, drain off water, and then with one sweep cause the developer to flow evenly and quickly over the whole surface of the print.

Developers.—Ferrous-oxalate.

A.	Oxalate of potash	1 pound	or	333 grammes.
	Bromide potass	5 grains	,,	0·2 gramme.
	Hot water	48 ounces	,,	1000 c. c.
B.	Sulphate of iron	1 pound	or	500 grammes.
	Citric acid	½ ounce	,,	16 ,,
	Hot water	32 ounces	,,	1000 c. c.

Take 6 ounces of A and 1 ounce of B.

Immediately after developing, the print must be transferred straight into the acid bath.

Acetic acid	1 drachm	or	4 c. c.
Water	32 ounces	,,	1000 ,,

WELLINGTON & WARD,

ELSTREE, HERTS.

Manufacturers of { Bromides, P. O. P.'s, Films, &c.

We strongly recommend the following

Metol Developer.

A.	Metol	400 grains	or	11 grammes.
	Sodium sulphite	8 ounces	,,	100 ,,
	Potass bromide	50 grains	,,	1·4 ,,
	Water	80 ounces	,,	1000 c. c.
B.	Potass carbonate	8 ounces	or	100 grammes.
	Water	80 ,,	,,	1000 c. c.

Take 3 ounces of A and 1 ounce of B.

The image should appear in a few seconds, and development will be complete in about 2 minutes. Rinse in 3 changes of water and fix in fixing bath as above (no acid bath is necessary with this developer).

To produce softer results, either of the above may be diluted with an equal quantity of water.

After fixing, wash thoroughly in several changes of water for at least 2 hours, squeegee off the superfluous moisture, and hang up to dry.

GEM DRY PLATE COMPANY'S FORMULÆ.

Developer for Plates and Films.

No. 1.	Pyrogallic acid	1 ounce	or	20 grammes.
	Potassium bromide	60 grains	,,	3 ,,
	Sulphite of soda	6 ounces	,,	120 ,,
	Water to	50 ,,	,,	1000 c. c.
No. 2.	Washing soda	6 ounces	or	120 grammes.
	Water to	50 ,,	,,	1000 c. c.

For use, take equal quantities of No. 1 and No. 2.

For known under-exposure use an increased proportion of No. 2.

For known over-exposure use larger quantity of No. 1.

Alum Bath.

Alum	1 ounce	or	50 grammes.
Water	20 ounces	,,	1000 c. c.

Wash before and after immersing in the alum bath.

ILFORD EMPRESS PLATES.
POPULAR PRICES THE BEST FOR SPRING and for all Hand Camera Work. FINE GRAIN.
THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Fixing Solution.

Hypo	1 pound	or	250 grammes.
Water	64 ounces	,,	1000 c. c.

LANTERN PLATES.

Developer for Cold or Warm Tones.

(Cold Tones.)

Hydroquinone.

A.	Hydroquinone	½ ounce	or	25 grammes.
	Citric acid	¼ ,,	,,	12 5 ,,
	Potassium bromide	60 grains	,,	7 ,,
	Water	20 ounces	,,	1000 c. c.
B.	Caustic soda	½ ounce	or	25 grammes.
	Sodium sulphite	3 ounces	,,	150 ,,
	Water	20 ,,	,,	1000 c. c.

For use, take equal parts of A and B, and dilute with water equal to their combined bulk.

(Warm Tones.)

C.	Ammonium carbonate	1 ounce	or	50 grammes.
	Ammonium bromide	1 ,,	,,	50 ,,
	Water	20 ounces	,,	1000 c. c.

For use, take of the above hydroquinone formula 2 parts, and add 1 part of C.

In obtaining either cold or warm tones, it is well to remember that exposure is the greatest factor. For cold tones, an exposure of 10 to 20 seconds, 1 foot from a No. 5 gas burner, will be ample, and develop as above. For warm and deeply coloured tones, expose from 30 seconds to 3 minutes, and develop with addition of C, always using a slightly increased proportion of C as the exposure is prolonged.

ILFORD ORDINARY PLATES.

POPULAR PRICES. THE BEST FOR SUMMER, and for all-round Work at all times.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

THE ILFORD FORMULÆ.

Stock Solutions.

A.	Water	5½ ounces.
	Nitric acid	20 minims.
	Pyrogallic acid	1 ounce.

This solution will keep good for several weeks.

Or B.	Water	5½ ounces.
	Potassium metabisulphite	70 grains.
	Pyrogallic acid	1 ounce.

This solution will keep good for several months.

Working Solutions.

No. 1.	Stock solution of pyro, A or B	1 to 2 ounces.
	Water to make up to	20 „
No. 2.	Sodium carbonate, crystals (not bicarbonate) (avoirdupois)	2 ounces.
	Sodium sulphite „	2 „
	Potassium bromide	20 grains.
	Water to make up to	20 ounces.

For normal exposures take equal quantities of Nos. 1 and 2.

The quantity of stock solution to be used must be regulated by the quality of negative desired. When a full quantity is used, the result is a slowing of the plate, and, at the same time, greater density or contrast of light and shade.

Pour the developer carefully over the plate, avoiding air bubbles, rock the dish, carefully keeping the plate well covered with solution. To obtain proper density, allow the plate to remain after all detail is out. Judge of this by looking through the plate.

To compensate for errors of exposure, the proportions of Nos. 1 and 2 can be varied thus: for under-exposure use more of No. 2 than of No. 1, and for over-exposure more of No. 1 than of No 2. It is a good plan, when there is a doubt as to the exposure being correct, to commence the development with twice the quantity of No. 1 than of No. 2, and add more of No. 2 if found desirable. To compensate for under-exposure, the mixed developer can also be diluted with water, of course allowing a longer time for its action.

ILFORD CHROMATIC PLATES.

POPULAR PRICES. THE BEST FOR AUTUMN, and for all Landscape Work at all Seasons.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Alum Bath.—After developing, wash the plate well under the tap, and immerse for a few minutes in alum, 1½ ounces; water, 20 ounces.

Fixing.—Wash well again, and fix as usual. Hyposulphite of soda, 1 pound; water, 40 ounces. Allow to remain in this bath for several minutes after fixation is apparently completed.

Never omit the alum bath in hot weather or under other conditions likely to produce frilling.

ILFORD P.O.P.

Working Instructions.

Printing.—This should be done in shade by preference, unless negatives are specially strong in contrast. The image loses very little depth in toning, &c.

First washing.—For 10 minutes in several changes.

Hardening Bath.—Soak the prints in

Alum	1 ounce,
Common salt	1 ,,
Water	20 ounces,

for 5 to 10 minutes, keeping them moving all the time.

Second washing.—For 10 minutes in several changes.

Toning.—Any of the recognised formulæ for this class of paper may be used, but for simplicity and excellence of results we recommend the following. Make up the following stock solutions:—

No. 1.	Ammonium sulphocyanide	100 grains.
	Water	10 ounces.
No. 2.	Sodium sulphite	10 grains.
	Water	10 ounces.

This solution must be made up only on the day of using; any left over must be thrown away.

No. 3.	Gold chloride	15 grains.
	Water	15 ounces.

When mixing either of the following toning baths, bear in mind that this solution must be added last of all.

For the usual toning bath, take 2 ounces of each of Nos. 1 and 3 and make up to 20 ounces with water.

For the special toning bath, which is strongly recommended, take 2 ounces of each of Nos. 1, 2, and 3, and make up to 20 ounces with water.

ILFORD Special Rapid PLATES.

POPULAR PRICES. THE BEST FOR WINTER, AND FOR SNAP SHOTS.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Third washing.—For 5 minutes in several changes.

Fixing.—Use new solution for each batch of prints. The following is best strength :—

Hypo	3 ounces.
Water	20 „

Fixation is complete in about 10 minutes.

Final washing.—For at least 2 hours in running water, or many changes.

Mounting.—Mount with starch paste in the usual way. Prints thus treated and passed through roll give a fine glossy surface, better than albumen. This paper will also give prints of enamelled surface by squeegeeing down on glass in the usual way.

Special notes.—Do not use any excess of sulphocyanide or sulphite over the quantity mentioned.

Use the washing water and all solutions as cold as possible.

Keep the prints moving whilst in the various solutions.

ILFORD BROMIDE PAPER AND OPALS.

Development.—Make the following solutions and use when cold :—

No. 1.	Sulphate of iron	2½ ounces.
	Sulphuric acid	15 drops.
	Warm water up to	10 ounces.
No. 2.	Neutral potassium oxalate	10 ounces.
	Potassium bromide	20 grains.
	Warm water up to	40 ounces.

For use, add 1 ounce No. 1 to 4 ounces No. 2, not *vice versâ*.

In cases of over-exposure or weak negatives, it is advisable to use half new and half old developer, to give greater brilliancy. Development is complete when image appears fully out. After development and without washing, immerse the prints for about 2 minutes in clearing solution, pour off and repeat.

Clearing Solution.

Water	80 ounces.
Glacial acetic acid	½ ounce.

Then wash thoroughly for about 10 minutes in several changes of water. All the acid must be removed, or fading of prints will result.

ILFORD PROCESS AND HALF-TONE PLATES.
THE BEST FOR PHOTO-MECHANICAL WORK.
THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Alternative Method of Development.

No. 1.	Metol	50 grains.
	Hydroquinone	25 ,,
	Sodium sulphite	1 ounce.
	Water up to	20 ounces.
No. 2.	Sodium carbonate (crystals)	½ ounce.
	Potassium bromide	30 grains.
	Water up to	20 ounces.

Take equal quantities of No. 1 and No. 2.

It is important to note that no clearing solution is required with this developer.

Fixing.

Water	20 ounces.
Hyposulphite of soda (avoirdupois)	¼ pound.

Allow 15 minutes for thorough fixation. Use fresh solution for each batch of prints.

After fixing, wash for 2 hours in running water or in frequent changes. Allow prints to dry naturally. Work with clean hands and clean dishes.

ILFORD FORMULÆ IN METRIC MEASURES.

Ilford Plates.

Stock Solutions.

A.	Pyro	28·4 grammes (1 ounce).
	Nitric acid	20 drops.
	Water	150 c. c.
Or B.	Pyro	28·4 grammes.
	Potassium metabisulphite	5 ,,
	Water	150 c. c.

Working Solutions.

No. 1.	Stock solution of pyro A or B	25 to 50 c. c.
	Water to make up to	500 ,,

ILFORD
'Special' & 'Alpha'
LANTERN
PLATES.
POPULAR PRICES.
THE BEST.
SPECIAL FOR COLD TONES.
ALPHA FOR WARM TONES.
THE BRITANNIA WORKS COMPANY, Limited,
ILFORD, LONDON, E.

No. 2.	Sodium carbonate	50 grammes.
	Sodium sulphite	50 ,,
	Potassium bromide	1·2 ,,
	Water to make up to	500 c. c.

Alum Bath.

Alum	30 grammes.
Water	400 c. c.

Fixing.

Hypo	400 grammes.
Water	1000 c. c.

ILFORD P.O.P.

Hardening Bath.

Alum	25 grammes.
Common salt	25 ,,
Water	500 c. c.

Toning.

No. 1.	Ammonium sulphocyanide	8 grammes.
	Water	350 c. c.
No. 2.	Sodium sulphite	0·8 gramme.
	Water	350 c. c.
No. 3.	Gold chloride (15 grain tube)	1 gramme.
	Water	425 c. c.

Fixing.

Hypo	75 grammes.
Water	500 c. c.

ILFORD BROMIDE PAPER AND OPALS.

Developer.

No. 1.	Sulphate of iron	50 grammes.
	Sulphuric acid	10 drops.
	Warm water up to	200 c. c.
No. 2.	Potassium oxalate	200 grammes.
	Potassium bromide	1 gramme.
	Warm water up to	800 c. c.

ILFORD FILMS.

POPULAR PRICES, THE BEST FOR ALL WHO TRAVEL.
See Price List for Varieties.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Clearing Solution.

Glacial acetic acid	10 c. c.
Water	1600 ,,

Alternative Developer.

No. 1.	Metol	4 grammes.
	Hydroquinone	2 ,,
	Sodium sulphite	35 ,,
	Water up to	700 c. c.
No. 2.	Sodium carbonate	17½ grammes.
	Potassium bromide	2·4 ,,
	Water up to	700 c. c.

Fixing.

Hypo	100 grammes.
Water	500 c. c.

PLATONA—ILFORD PLATINUM PAPER.

Printing.

Printing frame and pad should be quite dry.

Print until all details are faintly visible. Examine in weak light only.

Developing Formula—Stock Solution.

Potassium oxalate	2 ounces.
Potassium phosphate	½ ounce.
Water	14 ounces.

If unable to obtain potassium phosphate, the sodium phosphate may be substituted, but the former is preferable.

Dissolve the salts in hot water and allow to cool. This solution will keep indefinitely.

For use, take 1 part stock solution and 1 part water.

Develop in weak artificial or diffused light, floating prints face downwards in the solution. The image does not lose in fixing.

Fixing.

Pure hydrochloric acid	1 ounce.
Water	80 ounces.

ILFORD P. O. P.
POPULAR PRICES. THE BEST GELATINO-CHLORIDE PRINTING-OUT PAPER.
Used all over the World. See Price List for Varieties.
THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

Immerse prints for about 5 minutes each in three consecutive baths, and then give them a final washing in water for 15 minutes.

The prints are then ready to be dried and mounted.

Platona paper must be always kept stored in the tubes in which it is bought, and if so kept will remain in good condition. The cap should be kept screwed up, so that the tube is air-tight. Do not screw it up too hard, or it may be difficult to remove.

THE IMPERIAL COMPANY'S FORMULÆ.

'Imperial Standard' Developer.

No. 1.

Pyrogallic acid........................	55 grains	or	6 grammes.
Metol	45 ,,	,,	5 ,,
Metabisulphite of potash	120 ,,	,,	14 ,,
Bromide of potassium	20 ,,	,,	2 ,,
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

No. 2.

Carbonate of soda (washing soda)	4 ounces	or	200 grammes.
Water (boiled or distilled) to	20 ,,	,,	1000 ,,

For use take equal parts of No. 1 and No. 2.

'Imperial Universal' Developer.

No. 1.

Metol	40 grains	or	5 grammes.
Hydroquinone........................	50 ,,	,,	6 ,,
Sulphite of soda	120 ,,	,,	14 ,,
Bromide of potassium	15 ,,	,,	2 ,,
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

No. 2.

Caustic potash........................	180 grains	or	21 grammes.
Water (boiled or distilled) to ...	20 ounces	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

ILFORD BROMIDE PAPER.
POPULAR PRICES. THE BEST. SEE PRICE LIST FOR VARIETIES.
THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

'IMPERIAL PYRO-SODA' DEVELOPER.

Stock Solution.

Pyrogallic acid	1 ounce	or	111 grammes.
Bromide of potassium	60 grains	,,	13 ,,
Metabisulphite of potash	50 ,,	,,	10 ,,
Water (boiled or distilled) to	12 ounces	,,	1000 ,,

No. 1.

Stock solution	3 ounces	or	150 c. c.
Water (boiled or distilled)	20 ,,	,,	1000 ,,

No. 2.

Sulphite of soda	2 ounces	or	100 grammes.
Carbonate of soda	2 ,,	,,	100 ,,
Water (boiled or distilled) to	20 ,,	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

'IMPERIAL METOL' DEVELOPER.

No. 1.

Metol	100 grains	or	11·4 grammes.
Metabisulphite of potash	10 ,,	,,	1 ,,
Bromide of potassium	20 ,,	,,	2 ,,
Water (boiled or distilled) to	20 ounces	,,	1000 c. c.

No. 2.

Sulphite of soda	2 ounces	or	100 grammes.
Carbonate of soda	2 ,,	,,	100 ,,
Water (boiled or distilled) to	20 ,,	,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

'IMPERIAL HYDROQUINONE' DEVELOPER.

No. 1.

Hydroquinone	150 grains	or	17 grammes.
Metabisulphite of potash	10 ,,	,,	1 ,,
Bromide of potassium	50 ,,	,,	6 ,,
Water (boiled or distilled) to	20 ounces	,,	1000 c. c.

ILFORD ROUGH PLATONA PAPER.

POPULAR PRICES THE BEST For producing Beautiful Artistic Effects. A LOVELY PAPER.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

No. 2.

Sulphite of soda	2 ounces or	100 grammes.
Caustic soda..........................	100 grains ,,	11 ,,
Water (boiled or distilled) to......	20 ounces ,,	1000 c. c.

For use take equal parts of No. 1 and No. 2.

'IMPERIAL SINGLE-SOLUTION' DEVELOPER.

Metol	50 grains	or	5·7 grammes.
Hydroquinone	40 ,,	,,	4·6 ,,
Sulphite of soda	500 ,,	,,	57 ,,
Bromide of potassium..............	25 ,,	,,	3 ,,
Carbonate of soda	500 ,,	,,	57 ,,
Water (boiled or distilled) to......	20 ounces	,,	1000 c. c.

IMPERIAL 'SPECIAL' LANTERN PLATES.

For producing Transparencies of a Black Tone.

The exposure required for a negative of ordinary density will be about 5 seconds, at a distance of 24 inches from a medium-size gas-burner.

Developing formula (hydroquinone) is the same as that used with our ordinary plates.

For development, use 1 part of No. 1 to 1 part of No. 2, and 1 part of water.

Metol developer is also excellent.

After development, the manipulations, washing, &c., will be the same as for negatives.

IMPERIAL 'SLOW' LANTERN PLATES.

For producing Transparencies of a Warm Tone.

The exposure required for a negative of ordinary density will be about 15 seconds, at a distance of 12 inches from a medium-size gas-burner.

Developing formula (hydroquinone) is the same as that used with 'special' lantern plates.

IMPERIAL BROMIDE OPALS.

DEVELOPERS.

Metol. A.

No. 1. Metol	50 grains	or	11·4 grammes.
Dissolve in water	10 ounces	,,	1000 c. c.
Then add soda sulphite	1 ounce	,,	100 grammes.

ILFORD PLATONA PAPER.

POPULAR PRICES. THE BEST PLATINUM PAPER.
In Two Varieties, Rough & Smooth.

THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

No. 2.	Soda carbonate (washing soda)	2 ounces	or	200 grammes.
	Water to	10 ,,	,,	1000 c. c.
No. 3.	Potassium bromide	½ ounce	or	50 grammes.
	Water to	10 ounces	,,	1000 c. c.

The developer for normal exposures to consist of 3 parts of No. 1 to 1 part of No. 2, to each ounce of which may, as a rule, be added 20 minims of No. 3.

Oxalate and Iron. B.

No. 1.	Potash oxalate	4 ounces	or	250 grammes.
	Water	16 ,,	,,	1000 c. c.
No. 2.	Iron sulphate	3 ounces	or	250 grammes.
	Water	12 ,,	,,	1000 c. c.
	Citric acid	50 grains	,,	9 grammes.

Add 1 ounce of No. 2 to 5 ounces of No. 1; and to every ounce (30 c.c.) of developer add about 10 drops of a ten per cent. solution of potassium bromide.

No. 2 solution must always be added to No. 1 and not *vice versâ.*

MARION'S FORMULÆ.

For portraiture the following is recommended:—

Pyro Stock Solution.

Pyrogallic acid	1 ounce	or	50 grammes.
Sodium sulphite	4 ounces	,,	200 ,,
Sulphuric acid	1 drachm	,,	6 c. c.
Water to make up	20 ounces	,,	1000 ,,

Soda Stock Solution.

Sodium carbonate cryst	8 ounces	or	400 grammes.
Sodium sulphite	4 ,,	,,	200 ,,
Potassium bromide	1 drachm	,,	7 ,,
Water to make up	20 ounces	,,	1000 c. c.

ILFORD PHOTOGRAPHIC GOODS.
POPULAR PRICES. THE BEST ALWAYS. UNIFORM, RELIABLE, PERFECT.
THE BRITANNIA WORKS COMPANY, LIMITED,
ILFORD, LONDON, E.

For Development.

Five ounces of each stock solution made up separately to 20 ounces (1000 c. c.) with water and mixed in equal parts at the time of using. When very soft negatives are required—or only a minimum of exposure can be given—the bromide of potassium may be omitted.

PYRO-AMMONIA.

Pyrogallic acid........................	1 ounce	or	100 grammes.
Ammonium bromide	1 ,,	,,	100 ,,
Citric acid................................	1 drachm	,,	14 ,,
Water to make up	10 ounces	,,	1000 c. c.

AMMONIA.

Strongest liquid ammonia ·880	2 ounces	or	200 grammes.
Water to make up	10 ,,	,,	1000 c. c.

Two ounces of each of above separately made with water to 20 ounces, (1000 c. c.) form the solutions for use, equal parts being mixed together at the time of development.

HYDROQUINONE DEVELOPER.

Hydroquinone Solution.

Hydroquinone	40 grains	or	9 grammes.
Sodium sulphite, pure	120 ,,	,,	27 ,,
Potassium brom.	5 ,,	,,	1 ,,
Citric acid............................	5 ,,	,,	1 ,,
Water to make up to	10 ounces	,,	1000 c. c.

Alkali Solution.

Potass. hydrate, pure	120 grains	or	27 grammes.
Water to make up to	10 ounces	,,	1000 c. c.

This developer, mixed in equal proportions, will contain per ounce; Hydroquinone, 2 grains; sulphite, 6 grains; brom., ¼ grain; citric, ¼ grain; hydrate, 4 grains.

FOR GELATINO-CHLORIDE PLATES.

IRON.

For Cold Tones.

No. 1.	Potass. citrate	100 grains	or	230 grammes.
	Potass. oxalate	30 ,,	,,	69 ,,
	Hot distilled water to make up to	1 ounce	,,	1000 c. c.

For Warm Tones.

No. 2.	Citric acid	90 grains	or	206 grammes.
	Ammonium carbonate...........	60 ,,	,,	137 ,,
	Cold distilled water to make up to	1 ounce	,,	1000 c. c.

For Extra Warm Tones.

No. 3	Citric acid	130 grains	or	297 grammes.
	Ammonium carbonate	40 „	„	92 „
	Cold distilled water to make up to	1 ounce	„	1000 c. c.

In mixing the solutions Nos. 2 and 3, it is better to place the crystals of the salts into a deep vessel, and, after adding the water, leave alone till all effervescence ceases. It is advisable to make it over night.

To three parts of either of the above add one part of the following at the time of using:—

Sulphate of iron	120 grains	or	275 grammes.
Sulphuric acid	1 drop	„	2 c. c.

Make up with distilled water to 1 ounce 1000 c. c.

Either of these developers should give clear glass in the unexposed parts of the picture; but, if at any time the slightest fog is found, it should at once be cured by the addition of a trace of either potassium bromide or sodium chloride. Bromide is better with No. 1, and chloride with either No. 2 or No. 3. A convenient form of using these will be to keep a ten per cent. solution of each of these salts, and one or two minims to each ounce of developer will be found a powerful restrainer.

HYDROQUINONE.

No. 1.	Hydroquinone	48 grains	or	11 grammes.
	Sodium sulphite	320 „	„	73 „
	Ammonium bromide	2 „	„	0·5 „
	Water to make up to	10 ounces	„	1000 c. c.
No. 2.	Ammonium carbonate	100 grains	or	23 grammes.
	Sodium carbonate	100 „	„	23 „
	Water to make up to	10 ounces	„	1000 c. c.

Equal proportions of each are mixed together, according to size of plate to be developed at the time of using.

Different alkalies may be substituted for those mentioned, such as potassium carbonate, sodium silicate, potassium hydrate, sodium hydrate, &c.; but, in all cases, a small proportion of bromide should be used.

A number of plates may be developed one after the other in the same solution.

EIKONOGEN.

This developing agent, first introduced by us, will be found to give admirable results of a pleasing colour.

Formula.

Sulphite soda, pure	200 grains	or	46 grammes.
Eikonogen	50 „	„	11 „
Potassium bromide	5 „	„	1 „
Water to make up to	10 ounces	„	1000 c. c.

Sodium carbonate	160 grains	or	37	grammes.
Water to make up to	10 ounces	,,	1000	c. c.

Equal parts to be mixed together at time of using.

For Chloro-bromide Plates

Pyrogallic Development.

A.	Pyrogallic acid	40 grains	or	9	grammes.
	Pure sodium sulphite	16 ,,	,,	4	,,
	Citric acid	5 ,,	,,	1	,,
	Water	10 ounces	,,	1000	c. c.
B.	Liq. am. fort.	40 minims	or	8·3	c. c.
	Potassium bromide	40 grains	,,	9	grammes.
	Water to make up to	10 ounces	,,	1000	c. c.

Equal parts of the solutions to be mixed at the time of using.

A very pleasing warm colour will be obtained by adding to the B solution 200 grains (46 grammes) of ammonium carbonate, but the time of development will be increased.

Ferrous-oxalate Development.

The saturated solutions of potassic oxalate and iron sulphate may be used in the proportion of three or four parts of the former to one of the latter, with the addition of one grain of potassium bromide to each ounce of developer, adding more bromide and increasing the amount of exposure when warmer tones are required.

To keep the iron solution from oxidising, one drop of sulphuric acid should be added to each ounce of water before dissolving the salt.

The ferrous-oxalate gives a blacker-coloured image than pyrogallic developer.

The time of development will vary from two to four minutes, according to temperature and density of image required.

Hydroquinone Developer.

Hydroquinone Solution.

Hydroquinone	40 grains	or	9	grammes.
Sodium sulphite, pure	120 ,,	,,	27	,,
Potassium bromide	5 ,,	,,	1	,,
Citric acid	5 ,,	,,	1	,,
Water to make up to	10 ounces	,,	1000	c. c.

Alkali Solution.

Potassium hydrate, pure	80 grains	or	18	grammes.
Water to make up to	10 ounces	,,	1000	c. c.

Equal parts to be mixed together at time of using.

It is advisable that all solutions should be made with distilled water, though not absolutely essential.

Several plates may be developed in the same solution.

EIKONOGEN DEVELOPER.

This developer will be found to suit these equally well with slight modification.

A small proportion of bromide must be used to ensure absolute clearness in the unexposed parts.

Formula.

Sodium sulphite	400 grains	or	91 grammes.
Potassium bromide	5 ,,	,,	1 ,,
Eikonogen	100 ,,	,,	23 ,,
Water to make up to	10 ounces	,,	1000 c. c.

Sodium carbonate	320 grains	or	73 grammes.
Water to make up to	10 ounces	,,	1000 c. c.

Equal parts of each to be mixed together at time of using.

FOR ARGENTIC BROMIDE OPALS.

Formula for Amidol Developers.

Amidol	20 grains	or	5 grammes.
Sodium sulphite	200 ,,	,,	46 ,,
Potassium bromide	20 ,,	,,	5 ,,

Made up to 10 ounces (1000 c. c.) with water.

Form the developer in one solution ready for use. Plates developed with this formula will not require the acid bath previous to fixing.

Formula for Eikonogen Developer.

Eikonogen	40 grains	or	9 grammes.
Sodium sulphite	160 ,,	,,	37 ,,
Lithium carbonate	2 ,,	,,	0·5 ,,
Water to make up to	10 ounces	,,	1000 c. c.

This will keep for a considerable time if well corked.

One drop of a ten per cent. solution of potassium bromide may be added to each ounce of developer.

Plates developed with eikonogen will not require the acid bath previous to fixing.

MAWSON & SWAN'S FORMULÆ.

THE 'MAWSON' OR 'CASTLE' PLATE.

DEVELOPERS.

Pyro-ammonia Developer.

Stock Solution (ten per cent.).

Pyrogallic acid	480 grains	or	110 grammes.
Bromide of ammonium	240 ,,	,,	55 ,,
*Metabisulphite of potassium	480 ,,	,,	110 ,,
Distilled water to make up (fluid)	10 ounces	,,	1000 c. c.

Dissolve the metabisulphite in part of the water, then add the other ingredients, and make up to bulk with water.

A.	Stock solution........................	300 minims	or	62 c. c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,
B.	Liq. ammoniæ ·880	70 minims	or	14·5 c. c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Pyro-soda Developer.

A.	Pyrogallic acid	60 grains	or	14 grammes.
	*Metabisulphite of potassium......	15 ,,	,,	3·5 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Washing soda........................	600 grains	or	137 grammes.
	Sulphite of soda.....................	800 ,,	,,	183 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.

Use equal parts of A and B mixed at time of developing.

To correct errors in exposure:—If under-exposed, use a larger proportion of B; if over-exposed, decrease the proportion of B, and add a few drops of a ten per cent. solution of bromide of potassium.

* Metabisulphite of potassium is unequalled as a preservative of pyrogallic acid in solution. If not at hand, substitute, for each grain of metabisulphite, sulphuric acid ½ minim *plus* sulphite of soda, 2½ grains.

Eikonogen Developer.

A.	Eikonogen	100 grains	or	23 grammes.
	Sulphite of soda (recrystd.)	100 ,,	,,	23 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Carbonate of potassium (com.)	1200 grains	or	274 grammes.
	Sulphite of soda (recrystd.)	500 ,,	,,	114 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.

Use 3 parts of A to 1 part of B, mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grains	or	9 grammes.
	Metabisulphite of potassium......	40 ,,	,,	9 ,,
	Bromide of potassium	5 ,,	,,	1 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Caustic potass (sticks)	80 grains	or	18 grammes.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

THE MAWSON PHOTO-MECHANICAL PLATE.

DEVELOPERS.

Pyro-ammonia Developer.

A.	Pyrogallic acid	30 grains	or	7 grammes.
	Bromide of ammonium	30 ,,	,,	7 ,,
	Metabisulphite of potassium	30 ,,	,,	7 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Liq. ammoniæ ·880	70 minims	or	14·6 c. c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A	Hydroquinone	40 grains	or	9 grammes.
	Bromide of potassium	10 ,,	,,	2 ,,
	Metabisulphite of potassium	40 ,,	,,	9 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Caustic potass (sticks)	80 grains	or	18 grammes.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.

Use equal parts of A and B mixed at time of developing.

THE MAWSON LANTERN PLATE.

Developers.

Exposure.—A negative of average density requires about 15 seconds at 1 foot from a No. 6 bat's-wing burner. Short exposure tends to produce black tones; long exposure, brown tones.

Either of the following developers may be used, though we give the preference to the pyro-ammonia, greater variety of tone being available by it.

Development begins rather slowly, especially with the hydroquinone formula, afterwards proceeding more rapidly.

Pyro-ammonia Developer.

A.	Pyrogallic acid	20 grains	or	5 grammes.
	Bromide of ammonia	20 ,,	,,	5 ,,
	Metabisulphite of potassium	50 ,,	,,	11 ,,
	Distil. water to make up to (fluid)	10 ounces	,,	1000 c. c.
B.	Liq. ammoniæ ·880	70 minims	or	15 c. c.
	Distil. water to make up to (fluid)	10 ounces	,,	1000 ,,

Use equal parts of A and B mixed at time of developing.

Hydroquinone Developer.

A.	Hydroquinone	40 grains	or	9 grammes.
	Bromide of potassium	40 ,,	,,	9 ,,
	Metabisulphite of potassium	40 ,,	,,	9 ,,
	Distil. water to make up to (fluid)	10 ounces		1000 ,,

B.	Caustic potass (sticks)	80	grains	or	18	grammes.
	Distil. water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use equal parts of A and B mixed at time of developing.

Eikonogen Developer.

A.	Eikonogen	100	grains	or	23	grammes.
	Bromide of potassium	20	,,	,,	4·6	,,
	Sulphite of sodium (recrystd.)	100	,,	,,	23	,,
	Distil. water to make up to (fluid)	10	ounces	,,	1000	c. c.
B.	Washing soda	600	grains	or	137	grammes.
	Distil. water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use equal parts of A and B mixed at time of developing.

Ferrous-oxalate Developer.

A.	Neutral oxalate of potassium	1200	grains	or	274	grammes.
	Bromide of potassium	5	,,	,,	1	,,
	Citric acid	15	,,	,,	3	,,
	Distil. water to make up to (fluid)	10	ounces	,,	1000	c. c.
*B.	Ferrous sulphate	1600	grains	or	365	grammes.
	Citric acid	120	,,	,,	27	,,
	Distil. water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use 7 parts of A and 1 part of B, mixed at time of developing.

* Should this solution after keeping change to a brown colour, discard and mix afresh.

THE MAWSON OPAL PLATE.

Developer.

A.	Neutral oxalate of potassium	1200	grains	or	274	grammes.
	Bromide of potassium	5	,,	,,	1	,,
	Citric acid	15	,,	,,	3	,,
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.
B.	Ferrous sulphate	1600	grains	or	365	grammes.
	Citric acid	120	,,	,,	27	,,
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.

Use 7 parts of A and 1 part of B, mixed at the time of developing. Should B, after keeping, change to a brown colour, discard and mix afresh.

THE MAWSON BROMIDE PAPER.

Developer.

A.	Neutral oxalate of potassium	1200	grains	or	274	grammes.
	Bromide of potassium	5	,,	,,	1	gramme.
	Citric acid	15	,,	,,	3	grammes.
	Distilled water to make up to (fluid)	10	ounces	,,	1000	c. c.

B.	Ferrous sulphate	1600 grains	or	365 grammes.
	Citric acid	120 ,,	,,	27 ,,
	Distilled water to make up to (fluid)	10 ounces	,,	1000 c. c.

Use 7 parts of A and 1 part of B, mixed at the time of developing.

Should B, after keeping, change to a brown colour, discard and mix afresh.

THE PAGET PRIZE PLATE COMPANY'S FORMULÆ.

Pyro Ammonia.

No. 1.	Pyrogallic acid	1 ounce	or	50 grammes.
	Citric acid	60 grains	,,	7 ,,
	Sodium sulphite (pure)	2½ ounces	,,	125 ,,
	Distilled water to make	20 ,,	,,	1000 c. c.

No. 2.	Liq. ammoniæ ·880	1 ounce	or	50 c. c.
	Ammonium bromide	80 grains	,,	9 grammes.
	(For Phœnix plates, 120 grains or 14 grammes.)			
	Distilled water to make	20 ounces	,,	1000 c. c.

One part of each to 10 parts of water.

Pyro Soda.

No. 1.	Pyrogallic acid	¼ ounce	or	12·5 grammes.
	Sulphuric acid	5 drops	,,	0·5 c. c.
	Distilled water to make	20 ounces	,,	1000 ,,

No. 2.	Carbonate of soda (cryst. pure)	2 ounces	or	100 grammes.
	Sulphite of soda (pure)	2 ,,	,,	100 ,,
	Distilled water to make	20 ,,	,,	1000 c. c.

Equal parts of each.

Hydroquinone.

No. 1.	Hydroquinone	1 ounce	or	50 grammes.
	Methylated spirit	10 ounces	,,	500 c. c.
	Sulphurous acid	½ ounce	,,	25 ,,
	Potassium bromide	¼ ,,	,,	12 grammes.

Dissolve the hydroquinone in the spirit, and add the acid. In another vessel dissolve the potassium bromide in 3 ounces (150 c. c.) of distilled water. Mix the two solutions, and make up to 20 ounces (1000 c. c.) with distilled water.

No 2.	Caustic soda (in sticks)	1 ounce	or	50 grammes.
	Sodium sulphite	5 ounces	,,	250 ,,
	Distilled water to make	20 ,,	,,	1000 c. c.

One part of each to 4 parts of water.

If this be found to give too hard a negative, use more water.

Eikonogen.

No. 1.	Eikonogen	½ ounce	or	17 grammes.
	Sodium sulphite	1½ ,,	,,	50 ,,
	Potassium bromide	8 grains	,,	0·6 ,,
	Distilled water to make	30 ounces	,,	1000 c. c

Sixty grains (five grammes) hydroquinone added to above is a decided improvement, increasing brilliancy and density.

No. 2.	Potassium carbonate	1 ounce	or	100 grammes.
	Distilled water to make	10 ounces	,,	1000 ,,

Three parts of No. 1 to one part of No. 2.

Development.

For Black Tones any of the following formulæ are suitable :—

Pyro Ammonia.

Solution No. 1.

Pyrogallic acid	1 ounce	or	100 grammes.
Sodium sulphite	1½ ,,	,,	150 ,,
Citric acid	¼ ,,	,,	25 ,,
Distilled water to	10 ounces	,,	1000 c. c.

Solution No. 2.

Liquor ammoniæ, ·880..	1 ounce	or	100 grammes.
Ammonium bromide	1 ,,	,,	100 ,,
Distilled water to	10 ounces	,,	1000 ,,

For use, take 45 minims (4·7 c. c.) of each solution and make up with water to 2 ounces (100 c. c.).

Ferrous-oxalate Developer.

Solution No. 1.

Neutral oxalate of potash	16 ounces	or	320 grammes.
Citric acid	60 grains	,,	3 ,,
Hot water	50 ounces	,,	1000 c. c.

Solution No. 2.

Protosulphate of iron	4 ounces	or	500 grammes.
Citric acid	15 grains	,,	4 ,,
Hot water	8 ounces	,,	1000 c. c.

Solution No. 3.

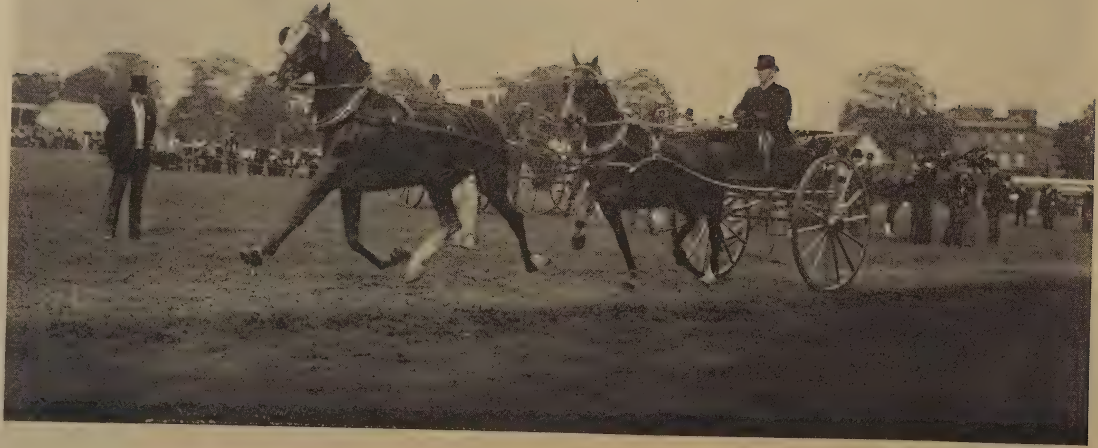
Bromide of potassium	¼ ounce	or	25 grammes.
Water	10 ounces	,,	1000 c. c.

For development, take 6 ounces (60 c. c.) of No. 1 and add 1 ounce (10 c. c.) of No. 2 and 24 drops (½ c. c.) of No. 3. Gives cold black tones.

Kilbey, Photo.

Taken in $\frac{1}{1000}$ second (not enlarged) with **Goerz Anschutz Folding Camera.** (See pages 378-379).

This picture took First Prize in the Warwick Plate Competition.



Taken in $\frac{1}{1000}$ second with a **Half**-plate **Goerz Anschutz Folding Camera.** *Kilbey, Photo.*
(See pages 378-379).

Eikonogen Developer.

Solution No. 1.

Eikonogen	½	ounce	or	17	grammes.
Sodium sulphite	1½	,,	,,	50	,,
Potassium bromide	8	grains	,,	0·4	,,
Distilled water to	30	ounces	,,	1000	c. c.

Solution No. 2.

Potassium carbonate	1	ounce	or	100	grammes.
Distilled water to	10	ounces	,,	1000	c. c.

Take three parts of No. 1 to one part of No. 2 solution.

Rodinal Developer.

Rodinal concentrated solution	1	part	or	33	c. c.
Water	30	parts	,,	1000	,,

This is a very clean developer, and gives a rich black colour.

Hydroquinone.

Solution No. 1.

Hydroquinone	½	ounce	or	25	grammes.
Sulphurous acid	¼	,,	,,	12·5	c. c.
Potassium bromide	60	grains	,,	7	grammes.
Water to	20	ounces	,,	1000	c. c.

Solution No. 2.

Caustic soda	½	ounce	or	25	grammes.
Sodium sulphite	2½	ounces	,,	125	,,
Water to	20	,,	,,	1000	c. c.

For use, take ½ ounce (50 c. c.) of each to 1 ounce (100 c. c.) of water.

Warm Tones.—Developer.

Solution No. 1.

Hydroquinone	½	ounce	or	25	grammes.
Sulphurous acid	¼	,,	,,	12·5	,,
Potassium bromide	60	grains	,,	7	,,
Water to	20	ounces	,,	1000	c. c.

Solution No. 2.

Caustic soda	½	ounce	or	25	grammes.
Sodium sulphite	2½	ounces	,,	125	,,
Water to	20	,,	,,	1000	c. c.

Solution No. 3.

Bromide of ammonium	1	ounce	or	50	grammes.
Carbonate of ammonium	1	,,	,,	50	,,
Water to	20	ounces	,,	1000	c. c.

Brown.

Exposure: 60 seconds 1 foot from gas-flame, or 2 inches of magnesium wire burnt at a distance of 3 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 100 minims (20 c. c.); water to 2 ounces (200 c. c.). Time required in development, about 5 minutes.

Purple-brown.

Exposure: 90 seconds 1 foot from gas-flame, or 3 inches of magnesium wire burnt at a distance of 3 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 200 minims (40 c. c.); water to 2 ounces (200 c. c.). Time required in development, about 10 minutes.

Purple.

Exposure: 3 minutes 1 foot from gas-flame, or 3 inches of magnesium wire burnt at a distance of 2 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 250 minims (50 c. c); water to 2 ounces (200 c. c.). Time required in development, about 12 minutes.

Red.

Exposure: 5 minutes 1 foot from gas-flame, or 5 inches of magnesium wire burnt at a distance of 2 feet. Developer: solution 1, ½ ounce (50 c. c.); solution 2, ½ ounce (50 c. c.); solution 3, 300 minims (60 c. c.); water to 2 ounces. Time required in development, about 15 minutes.

PRINTING-OUT OPALS AND LANTERN PLATES.

Combined Toning and Fixing Bath.

No. 1 Stock.

Hyposulphite of soda	20 ounces	or	125 grammes.
Alum (potash alum only)	5 ,,	,,	31 ,,
Sodium sulphate (not sulphite)	14 ,,	,,	88 ,,
Water to	1 gallon	,,	1000 c. c.

Dissolve the hypo and alum each in about one quart (250 c. c.) of hot water, mix, and then add sodium sulphate already dissolved, making up to one gallon with remainder of water. This mixture should then be left for some hours for the precipitate to settle, when the clear solution may be poured off or filtered, and is then ready for use. It will keep indefinitely.

No. 2 Stock.

Gold chloride	15 grains	or	4 grammes.
Acetate of lead	64 ,,	,,	18 ,,
Water (distilled)	8 ounces	,,	1000 c. c.

Dissolve the acetate of lead in the water, and add the gold. A heavy precipitate forms in this solution, which should be shaken up when any is to be poured out: it redissolves when added to No. 1 stock solution. For use: Mix 8 oz. of No. 1 with 1 oz. of No. 2. When this bath is used, the prints should *not* be washed *before* toning.

Separate Toning Bath.

Sulphocyanide of ammonium	30 grains	or	4 grammes.
Gold chloride	2½ ,,	,,	0·4 ,,
Water	16 ounces	,,	1000 c.c.

BROMIDE OPALS.

Development.

For black tones the following developer is the one chiefly used:—

Ferrous-oxalate Developer.

Solution 1.

Neutral oxalate of potash	16 ounces	or	320 grammes.
Citric acid	60 grains	,,	3 ,,
Hot water	50 ounces	,,	1000 c.c.

Solution 2.

Protosulphate of iron	4 ounces	or	500 grammes.
Citric acid	¼ ounce	,,	31 ,,
(Or acetic acid, ½ drachm or 8 c.c.)			
Hot water	8 ounces	,,	1000 c.c.

Solution 3.

Bromide of potassium	¼ ounce	or	25 grammes.
Water	10 ounces	,,	1000 c.c.

For development take (when cold) 6 ounces (600 c.c.) of No. 1, and add 1 ounce (100 c.c.) of No. 2 and ½ drachm (6 c.c.) of No. 3.

For warm black tones use the hydroquinone developer, made up as follows:—

Hydroquinone Developer.

Solution 1.

Hydroquinone	½ ounce	or	10 grammes.
Sulphurous acid	¼ ,,	,,	5 ,,
Potassium bromide	60 grains	,,	3 ,,
Water to	50 ounces	,,	1000 c.c.

Solution 2.

Caustic soda	½ ounce	or	10 grammes.
Sodium sulphite	2½ ounces	,,	50 ,,
Water to	50 ,,	,,	1000 c.c.

For use take equal parts of the two solutions. By increasing the exposure and using less of No. 1 Solution, still browner images can be obtained. Other developers, such as eikonogen, pyro, rodinal, &c., can also be used.

ROUCH'S FORMULÆ.

A.	Pyrogallic acid	1 ounce	or	100 grammes.
	Sulphite of soda	4 ounces	,,	400 ,,
	Water, to make	10 ,,	,,	1000 c. c.

Dissolve the sulphite of soda in hot water, and, when cold, add the pyrogallic acid. Should any portion of the sulphite refuse to dissolve, the crystals may be allowed to remain in the bottle.

B.	Bromide of ammonium	1 ounce	or	100 grammes.
	Water, to make	10 ounces	,,	1000 c. c.

C.	Strongest liquor ammoniæ	3 ounces	or	300 c. c.
	Water, to make	10 ,,	,,	1000 ,,

In case sulphite of soda be not readily obtainable, the following may be substituted for solution A as above, and used in the same manner:—

Pyrogallic acid	1 ounce	or	100 grammes.
Citric acid	50 grains	,,	11 ,,
Water, to make	10 ounces	,,	1000 c. c.

Dissolve the citric acid first, and then add the pyro.

THE SANDELL WORKS COMPANY'S FORMULÆ.

A. Pyro Potash.

No. 1.	Pyro	1 ounce	or	28 grammes.
	Sulphite soda	3 ounces	,,	85 ,,
	Bromide potassium	¾ ,,	,,	21 ,,
	Citric acid	60 grains	,,	4 ,,
	Boiled or distilled water to	10 ounces	,,	300 c. c.
No. 2.	Carbonate potash	2 ounces	or	56 grammes.
	Sulphite soda	2 ,,	,,	85 ,,
	Boiled or distilled water to	10 ,,	,,	300 ,,

B. Hydroquinone Metol.

No. 1.	Hydroquinone	200 grains	or	13 grammes.
	Metol	20 ,,	,,	1·5 ,,
	Sulphite soda	3 ounces	,,	85 ,,
	Bromide potassium	30 grains	,,	2 ,,
	Citric acid	30 ,,	,,	2 ,,
	Boiled or distilled water to	20 ounces	,,	600 ,,
No. 2.	Carbonate soda crystals	2 ounces	or	56 grammes.
	Caustic soda	60 grains	,,	4 ,,
	Boiled or distilled water to	20 ounces	,,	600 c. c.

C. Metol.

No. 1.	Metol	120 grains	or	8 grammes.
	Sulphite soda	2 ounces	,,	56 ,,
	Bromide potassium	129 grains	,,	8 ,,
	Boiled or distilled water to	20 ounces	,,	600 c. c.
No. 2.	Carbonate soda crystals	2 ounces	or	56 grammes.
	Boiled or distilled water to	20 ,,	,,	600 c. c.

D. Pyro Ammonia.

No. 1.	Pyro	1 ounce	or	28 grammes.
	Sulphite soda	3 ounces	,,	85 ,,
	Bromide ammonium	1 ounce	,,	28 ,,
	Citric acid	120 grains	,,	8 ,,
	Boiled or distilled water to	10 ounces	,,	300 c. c.
No. 2.	Liquid ammonia, ·880	1 ounce	or	30 c. c.
	Boiled or distilled water	10 ounces	,,	300 ,,
No. 3.	Bromide ammonium	1 ounce	or	30 grammes.
	Boiled or distilled water	10 ounces	,,	300 c. c.

THOMAS'S FORMULÆ.

Lantern or Transparency Plates.

Developing Formulæ.

Black Tones.

No. 1.	Hydroquinone	160 grains	or	10 grammes
	Sodium sulphite	4 ounces	,,	110 ,,
	Citric acid	60 grains	,,	4 ,,
	Potassium bromide	160 ,,	,,	10 ,,
	Water to	20 ounces	,,	560 c. c.
No. 2.	Sodium hydrate	160 grains	or	10 grammes.
	Water to	20 ounces	,,	560 c. c.

Take equal parts of each solution, and development should be completed in three to four minutes. The plates should be somewhat overdeveloped, as they lose density in fixing.

Cold Tones.

No. 1.	Pyrogallic acid	1 ounce	or	28 grammes.
	Metabisulphite of soda	1 ,,	,,	28 ,,
	Water to	100 ounces	,,	2830 c. c.
No. 2.	Washing soda	6 ounces	or	170 grammes.
	Potassium bromide	20 grains	,,	1·3 ,,
	Water to	100 ounces	,,	2830 c. c.

Take equal parts of each solution, and development should be completed in five to seven minutes. Slightly over-develop to allow for loss in fixing.

Purple Tones.

No. 1.	Pyrogallic acid	1 ounce	or	28 grammes.
	Metabisulphite of soda	1 ,,	,,	28 ,,
	Water to	80 ounces	,,	2250 c. c.
No. 2.	Ammonium bromide	8 ounces	or	225 grammes.
	Liq, ammoniæ ·880	4 ,,	,,	110 c. c.
	Water to	80 ,,	,,	2250 ,,

Use equal parts of each solution.

This developer allows great latitude in exposure, and takes from three to twelve minutes to develop, according to the amount of exposure given.

When using this developer, the image will appear buried and lacking in density if examined by ruby light, but, when fixed, will be fully dense, and the deposit will appear opaque by reflected light, and purple by transmitted light, improving in colour when dry.

Fixing Bath.

Hyposulphite of soda	4 ounces	or	110 grammes.
Ten per cent. solution of metabisulphite of soda	1 ounce	,,	28 c. c.
Water to	20 ounces	,,	560 ,,

PYRO AND SODA DEVELOPER.

No. 1.	Pyrogallic acid	1 ounce	or	12·5 grammes.
	Metabisulphite of soda	1 ,,	,,	12·5 ,,
	Water to	80 ounces	,,	1000 c. c.
No. 2.	Carbonate of soda (washing soda)	6 ounces	or	75 grammes.
	Water to	80 ,,	,,	1000 c. c.

For use, take equal parts of Nos. 1 and 2. For full exposure and in hot weather, 2 to 5 drops of a ten per cent. solution of potassium bromide may be added to each ounce. For under-exposure and isochromatic emulsions, this developer may be still further diluted.

Fixing Bath.

Hyposulphite of soda	1 pound	or	200 grammes.
Water to make	80 ounces	,,	1000 c. c.

WRATTEN & WAINWRIGHT'S FORMULÆ.

DEVELOPING FORMULÆ.

Ten per cent. Pyro and Ammonia.

A. Liquor ammoniæ	1 ounce	or	100 c. c.
Bromide potassium	110 grains	,,	22 grammes.
Water	10 ounces	,,	1000 c c.
B. Pyro	1 ounce	or	100 grammes.
Citric acid	60 grains	,,	12 ,,
or sulphuric acid	½ drachm	,,	6 c. c.
Water	10 ounces	,,	1000 c. c.

For Instantaneous and Ordinary take from 60 (3 c. c.) to 90 minims (5 c. c.) and for Drop Shutter 90 minims (5 c. c.) of Solution B, dilute with from 2 to 4 ounces (60 to 120 c. c.) of water, and add 100 minims (6 c. c.) of Solution A.

It is better to add Solution A by instalments as development proceeds, unless the exposure is known to be either insufficient or quite accurate, in which cases it may be added in one quantity.

The addition of 2 ounces (200 grammes) sulphite of soda to Solution B retards discolouration and improves the tone of the negative, but slightly prolongs the operation of development.

PYRO SODA.

We recommend this developer for studio and hand-camera work.

No. 1. Sulphite soda	6 ounces	or	75 grammes.
Water	80 ,,	,,	1000 c. c.
Sulphuric acid or citric acid	1 drachm	,,	1·5 ,,
Pyro	1 ounce	,,	13 grammes.
No. 2. Soda carbonate	6 ounces	,,	75 ,,
Water	80 ,,	,,	1000 c. c.

For use, take equal parts of Nos. 1 and 2.

The best printing results in hand-camera work may be obtained by developing with the above developer or the pyro acetone, and diluting with from 1 to 1½ times its bulk with water. Time from 10 to 20 minutes; without dilution, 3 to 5 minutes.

METOL.

A. Metol	50 grains	or	10 grammes.
Water	10 ounces	,,	1000 c. c.

When dissolved, add

Soda sulphite	1 ounce	,,	100 grammes.
B. Soda carbonate	2 ounces	or	200 grammes.
Or potass. carbonate	1 ounce	,,	100 ,,
Water	10 ounces	,,	1000 c. c.

C. *Ten per cent. Potass. Bromide Solution.*

Potass. bromide	1 ounce	or 100 grammes.
Water..................................	10 ounces	,, 1000 c. c.

Mix 3 parts A with 1 part B, dilute with an equal bulk of water, and add 20 minims (1·5 c. c.) ten per cent. bromide solution C.

If more density and contrast be required, use the solution more concentrated, dilution giving softness according to its degree.

PYRO ACETONE.

No. 1.—Same as pyro soda No. 1.

No. 2.—Acetone, 10 ounces or 250 c. c.; water, 40 ounces or 1000 c. c.

For use, take equal parts Nos. 1 and 2; or, for more contrast, No. 1, 2 parts; No. 2, 1 part.

For over-exposure add ten per cent. bromide solution from 5 minims (·3 c. c.) upwards according to necessity.

For use with the London Drop-shutter Special always add 5 minims (·3 c. c.) of ten per cent. bromide solution *before* application.

This developer gives reddish-brown tones, is controllable by the addition of bromide, produces a good even printing density, and is excellent for under-exposure.

The total time of development is about the same as with pyro soda, although the image makes a quicker appearance.

It does not soil the hands.

Rodinal used in the proportion of 1 to 25 yields brilliant results, its applicability is very comprehensive, suiting nearly all subjects.

Temperature of water and solutions should be about 60° F. or 15 C.

Fixing.—Either a plain A or an acid B fixing bath may be used, giving a brown or a blackish tint respectively after pyro-ammonia development.

A.	Hyposulphite soda	4 ounces or	200 grammes.
	Water	20 ,,	,, 1000 c. c.
B.	Hyposulphite soda	5 ounces or	250 grammes.
	Water	20 ,,	,, 1000 c. c.
	Sulphite soda	1 ounce ,,	50 grammes.
	When dissolved, add slowly, stirring all the time,		
	Sulphuric acid	1 drachm or	6 c. c.

Formalin will be found very useful during hot or thundery weather in preventing decomposition during prolonged washing, and should be used according to maker's directions.

N.B.—The equivalents of English and French measures above given are approximate.

THE GELATINO-CHLORIDE PROCESS.

BARKER'S FORMULA FOR PRINTING-OUT EMULSION.

Gelatine (Nelson's No. 1 and Coignet's, equal parts)	175 grains	or	80 grammes.
Chloride of ammonium	18 ,,	,,	8 ,,
Rochelle salts	50 ,,	,,	23 ,,
Nitrate of silver	75 ,,	,,	34 ,,
Alcohol	4 drachms	,,	100 c. c.
Water	5 ounces	,,	1000 ,,

Heat to 100° Fahr. (38° C.), and allow to remain at this temperature after all is dissolved for ten minutes, after which proceed in the usual way.

Toning Baths for the Foregoing.

Wash the prints in clean water and then *tone* in the following:—

1. A.	Distilled water	25 ounces	or	1000 c. c.
	Acetate of soda (recrystallised)	1 ounce	,,	40 grammes.
	Into which pour a solution of 1 per cent. of chloride of gold	2 ounces	,,	80 c. c.

B. In ten ounces (1000 c. c.) of distilled water, dissolve two drachms (25 grammes) of sulphocyanide of ammonium, and add one ounce (100 c. c.) solution of 1 per cent. chloride of gold.

For toning, mix in the proportion of twenty ounces of A to six of B. if possible the evening before using.

Another.

2. A.	Water	3 ounces	or	1000 c. c.
	Chloride of gold	2 grains	,,	1½ grammes.
B.	Water	3 ounces	or	1000 c. c.
	Sulphocyanide of ammonium	40 grains	,,	30 grammes.
	Hyposulphite of soda	1 grain	,,	0·8 ,,
	Carbonate of soda	3 grains	,,	2 ,,

These are mixed together by one part of A being poured into an equal part of B; in no case the reverse.

SOLIO COMBINED TONING AND FIXING BATH.

No. 1.

Hypo	20 ounces	or	125 grammes.
Alum	5 ,,	,,	31 ,,
Soda sulphate	10 ,,	,,	62 ,,
Potash sulphate	2 ,,	,,	12 ,,
Water	160 ,,	,,	1000 c. c.

No. 2.

Gold chloride	15 grains or	4·3 grammes.
Lead acetate	64 ,, ,,	18 ,,
Water	8 ounces ,,	1000 c. c.

For use, eight parts of No. 1 solution; one part of No. 2.

A red precipitate is thrown down in the gold solution, but, if shaken before addition to the hypo, it will be redissolved.

Formula for Blue Tones.

No. 1.

Borax	600 grains or	9 grammes.
Water	160 ounces ,,	1000 c. c.

No. 2.

Gold chloride	15 grains or	2·3 grammes.
Water	15 ounces ,,	1000 c. c.

For use, eight parts of No. 1; half part of No. 2. The solutions must be kept separate.

A COMBINED TONING AND FIXING BATH.

Water	20 ounces or	1000 c. c.
Hypo	5 ,, ,,	250 grammes.
Citric acid	60 grains ,,	7 ,,
Acetate of lead	60 ,, ,,	7 ,,
Sulphocyanide of ammonium	240 ,, ,,	27 ,,

These are added, and dissolved in the order given, and the solution allowed to stand for twenty-four hours. A precipitate will then be thrown down, and the clear solution decanted off. Then add—

Chloride of gold .... 3 grains or 3·4 grammes.

IMPERIAL P.O.P.

Directions for Use.

Hard negatives should be printed in strong light, delicate negatives only in the shade.

Prints should be rather darker than the finished picture is desired.

We specially recommend the following bath and mode of procedure for excellence and uniformity of result.

After printing, wash thoroughly for ten to fifteen minutes in running water before immersion in the Toning Solution.

In hot weather, if the surface of the prints become soft, immerse after washing, in an alum bath (alum 1 ounce, water 10 ounces), leave for ten minutes, wash again in running water for five to ten minutes and place in the following toning bath.

SULPHOCYANIDE TONING BATH.

Stock Gold Solution.

Chloride of gold	15 grains	or	18 grammes.
Water (distilled or boiled) to...	15 drachms	,,	1000 c. c.

No. 1.	Sulphocyanide of ammonium	75 grains	or	8·5 grammes.
	Water (boiled or distilled) to	20 ounces	,,	1000 c. c.
No. 2.	Stock gold solution...............	5 drachms	or	31 c. c.
	Water to	20 ounces	,,	1000 ,,

For use, take equal quantities of No. 1 and No. 2.

Add solution No. 2 slowly to solution No. 1, stirring all the time. Make up the solutions exactly as above, and follow out the instructions carefully.

The prints should tone in five to ten minutes.

When toning has been judged sufficient, wash for about five minutes and transfer to the following fixing bath :—

Hyposulphite of soda	3 ounces	or	150 grammes.
Water to	20 ,,	,,	1000 c. c.

After fixation is complete (about ten minutes), wash thoroughly for one hour.

THE SYLVIO PAPER.

WELLINGTON & WARD, ELSTREE, HERTS.

The phosphate toning bath is recommended :—

Phosphate of soda	40 grains	or	6 grammes.
Gold chloride	2 ,,	,,	0·3 ,,
Water	16 ounces	,,	1000 c. c.

The bath should be used as soon as it is mixed.

VELOX DEVELOPERS.

Metol Quinol.

Water	10 ounces	or	1000 c. c.
Metol	7 grains	,,	1·6 grammes.
Sodium sulphite, crystals pure...	½ ounce	,,	50 ,,
Hydroquinone	30 grains	,,	7 ,,
Sodium carbonate, desiccated*	200 ,,	,,	45 ,,

Ten per cent. bromide of potassium solution, about 10 drops.

Amidol.

Water	4 ounces	or	1000 c. c.
Sodium sulphite, crystals pure...	200 grains	,,	114 grammes.
Amidol	20 ,,	,,	11 ,,

Ten per cent. bromide of potassium solution, about 5 drops.

Metol.

Water	10 ounces or	1000 c. c.
Metol	25 grains ,,	5 7 grammes.
Sodium sulphite, crystals pure...	½ ounce ,,	50 ,,
Sodium carbonate, desiccated*...	120 grains ,,	27 ,,

Ten per cent. bromide of potassium solution, about 20 drops.

* If you use crystallised carbonate of sodium, take double this quantity.

Hypo Acid Fixing Bath.

Hypo	16 ounces or	250 grammes.
Water	64 ,, ,,	1000 c. c.

Then add the following hardening solution:—

Water	14½ ounces or	1000 c. c.
Sodium sulphite, crystals	1 ounce ,,	69 grammes.
Acetic acid, glacial acetic 51°	1½ ounces ,,	104 ,,
Powdered alum	1 ounce ,,	69 ,,

PAGET PRIZE GELATINO-CHLORIDE PRINTING-OUT PAPER.

Ordinary or Matt Surface.

Printing should be somewhat darker than the finished print is required.

It should be borne in mind, when toning, that the finished image will be bluer and slightly stronger when dry than in the wet state.

Toning.—The following bath is strongly recommended in preference to any other:—

Sulphocyanide of ammonia	30 grains or	4 grammes.
Gold chloride	2½ ,, ,,	0·4 ,,
Water	16 ounces ,,	1000 c. c.

Before immersion in this toning bath, the prints should be *very thoroughly washed* for at least fifteen minutes in running water. This is necessary to ensure even toning.

If the toning bath be found to tone too quickly, sulphite of soda equal in quantity to the gold used (*i.e.*, 2½ grains for above quantity) may be added. This will make the bath work more slowly, without making any other difference. More or less may be used so as to regulate to speed desired. The sulphite should be kept in a stock solution and added to the bath immediately before use.

In hot weather, if necessary, the print may be soaked in alum (alum, 4 ounces; water, 20 ounces) for five minutes before toning in this bath. Another thorough washing is necessary between the alum and toning baths.

MARIONA PAPER (P.O.P.).

Directions.—Print as with albumenised papers, slightly darker than required for the finished picture, or for partial development, as instructions below.

Washing.—After printing, wash thoroughly in several changes of water from ten to fifteen minutes.

Toning.—This paper may be toned with any of the usual baths, but the following are recommended:—

PLATINUM TONING.—FOR SEPIA TONES.

Stock Solution.

A. Potassium chloro-platinite, 15 grains (2·3 grammes) in 15 ounces (1000 c. c.) of water, to which have been previously added 5 minims (½ c. c.) of hydrochloric acid.

B.			
Citric acid	160 grains	or	46 grammes.
Chloride sodium	160 ,,	,,	46 ,,
Water	8 ounces	,,	1000 c. c.

Take 2 ounces (60 c. c.) from A and 1 ounce (30 c. c.) from B, and make up to 1½ pints (900 c. c.) with water. This is sufficient for toning two sheets.

GOLD TONING.—CARBONATE BATH.

A. Stock solution of gold chloride, 15 grains tube in 15 ounces of water (2·3 grammes per litre).

B. Sodium carbonate (common washing soda), 30 grains in 15 ounces of water. (4½ grammes per litre.)

Take 2½ ounces (75 c. c.) each of A and B, and make up to 1 pint (600 c. c.). This should tone about 2½ sheets of paper.

GOLD TONING.—SULPHOCYANIDE BATH.

A. Stock solution of gold chloride, 15 grains in 15 ounces of water (2·3 grammes per litre).

B. Stock solution of ammonium sulphocyanide containing 15 grains to every ounce of water (35 grammes per litre).

For use, take 1 ounce (28 c. c.) each of A and B, and make up to 8 or 10 ounces (about 250 c. c.) with water, for each sheet of paper to be toned. The bath should be fresh every time.

Washing after Toning.—To be thoroughly washed in several changes of water, then placed in the fixing bath.

Fixing Bath.—Dissolve 3 ounces (150 grammes) of hypo in 1 pint of water (1000 c. c.). Keep the prints moving for at least 10 minutes.

Final Washing.—In running water, or several changes of water, for at least two hours.

Alum Bath.—In warm weather or hot climates it is advisable to use this bath before toning; strength about ten per cent, or chrome alum one per cent, for ten minutes, prints being again thoroughly washed before toning.

Partial Development.—This method will be found very convenient in dull weather, or even at night by magnesium or electric light. Print till the image is fairly visible, then immerse without washing in a ten per cent. solution of potassium bromide for four or five minutes. Then, after washing for a few minutes, place the print in the following developer mixed in equal proportions:—

A.	Hydroquinone	80 grains or	9 grammes.
	Sodium sulphite	320 ,, ,,	37 ,,
	Make up with distilled water to	20 ounces ,,	1000 c. c.
B.	Sodium carbonate	400 grains or	460 grammes.
	Ammonium carbonate	400 ,, ,,	460 ,,
	Ammonium bromide	40 ,, ,,	46 ,,
	Make up with distilled water to	2 ounces ,,	1000 c. c.

Continue the development until all but the faintest details are visible, then immediately wash the print thoroughly in running water to remove entirely the developer before placing it in the toning bath. All after-treatment will be the same as given above for printed-out prints.

THE COLLODIO-CHLORIDE PROCESS.

PAGET PRIZE COLLODIO-CHLORIDE PRINTING-OUT PAPER.

Printing should be somewhat darker than the finished print is required; about the same as for our P.O.P., not quite so dark as for albumen.

Keeping.—Both the unprinted pieces of paper and the untoned prints are best kept in a cool place, closely packed together, flat, and under slight pressure. If left loosely exposed to the air, the collodion film may dry and harden, becoming more liable to crack during the toning and subsequent operations. Toning should be done as soon after printing as convenient; the same day, or, at farthest, the next day if possible.

Washing.—Before immersion in the toning bath, the prints should be *very thoroughly washed* for at least five minutes in running water or in three or four changes. If running water from a tap be used, it should not be turned on too violently, as it may tear or injure the film.

Alum.—After washing, it is strongly recommended that the prints be placed in an alum bath (alum, 4 ounces; water, 1 pint) for five minutes, and then washed for a quarter of an hour before toning. The alum has no action on the collodion film, but hardens the prepared paper underneath, and effectually prevents any softening or peeling in the subsequent operations. If the alum be well washed out, toning proceeds even more easily than if alum had not been used.

Toning.—Any of the ordinary toning baths employed for albumen or gelatine may be used, but no bath gives such rich, brilliant tones, either warm or cold, as the sulphocyanide. If a little care be taken to ensure clean dishes and clean fingers, there is no bath more simple or certain. We strongly recommend this bath in preference to any other.

Sulphocyanide of ammonia	30 grains	or	4 grammes.
Gold chloride	2 ,,	,,	0·3 ,,
Water	16 ounces	,,	1000 c. c.

Tone to exactly the colour desired, judging the prints as they lie in the dish; but it should be borne in mind that the finished image will be slightly bluer and stronger when dry than in the wet state. Wash and fix in

Hyposulphite of soda	3 ounces	or	150 grammes.
Water	1 pint	,,	1000 c. c.

If this bath be found to tone too quickly, sulphite of soda may be added at the rate of ¼ to ½ grain for every grain of gold used (say 1 grain for above quantity). This will make the bath work more slowly, without making any other difference. More or less may be used, so as to regulate to speed desired. The sulphite should be kept in a stock solution, and added to the bath immediately before use.

Allow at least ten minutes for fixing. Wash thoroughly in running water for at least an hour. Do not on any account wash longer than two hours; never leave in the water all night.

The prints may be damped off on blotting-paper and left to dry, or may be dried quickly in a moderate heat. They should *not* be left to dry *between* blotting-paper unless the latter is known to be pure. Impure blotting-paper makes spots and mottled marks on the prints.

THE ALBUMEN PROCESS.

PRESERVATIVES FOR SENSITISED ALBUMEN PAPER.

1.—Sensitise the paper in the usual bath, drain well, and when superficially dry float the back of the paper for twenty minutes on a solution of

Citric acid	1 ounce	or	33 grammes.
Water	30 ounces	,,	1000 c. c.

Or,

2.—Sensitise as usual, drain well, and wash the paper in three or four changes of water, then float the back on a solution of

Nitrite of potassium	5 ounces	or	50 grammes.
Water	100 ,,	,,	1000 c. c.

When dry, roll the paper up, coated side out, and wrap in blotting-paper soaked in the nitrite of potash solution, and dried.

TONING FORMULÆ FOR ALBUMEN PRINTS.

No. 1.	Chloride of gold	1 grain	or	0·3 grammes.
	Acetate of soda	30 grains	,,	9 ,,
	Water	8 ounces	,,	1000 c. c.

This must not be used till one day after preparation. It keeps well, and gives warm, rich tones.

No. 2.	Chloride of gold	1 grain	or	0·3 grammes.
	Bicarbonate of soda	4 grains	,,	1 gramme.
	Water	8 ounces	,,	1000 c. c.

This is ready for immediate use after preparation, but it will not keep.

No. 3.	Chloride of gold	1 grain	or	0 3 grammes.
	Phosphate of soda	20 grains	,,	6 ,,
	Water	8 ounces	,,	1000 c. c.

This gives rich tones of a deep purple nature, but must be used soon after preparation.

No. 4.	Gold solution	10 drachms	or	63 c. c.
	Acetate of lime	20 grains	,,	2 grammes.
	Chloride of lime	1 grain	,,	0·1 ,,
	Tepid water	20 ounces	,,	1000 c c.

The 'gold solution' before mentioned is prepared by neutralising as much as is required of a one-grain solution of chloride of gold by shaking it up with a little prepared chalk, then allowing it to settle, and filtering off the clear liquid. This toning bath improves by keeping. To use, add two ounces of it to eight ounces of tepid water, which will prove sufficient to tone a full-sized sheet of paper.

No. 5.	Chloride of gold	15 grains	or	7 grammes.
	Water	5 ounces	,,	1000 c. c.

Neutralise with lime water, make up to fifteen ounces (3000 c. c.) with water, and add two drachms (54 grammes) of chloride of calcium. This stock solution will keep for a long time for use. Dilute one ounce with ten ounces of water.

Toning and Fixing in One Bath.

No. 6.	Chloride of gold	1 grain	or	1 gramme.
	Phosphate of soda	15 grains	,,	17 grammes.
	Sulphocyanide of ammonium	25 ,,	,,	28 ,,
	Hyposulphite of soda	240 ,,	,,	275 ,,
	Water	2 ounces	,,	1000 c. c.

Dissolve the gold separately in a small quantity of water, and add to the other solution.

INGALL'S TONING FORMULA.

Hard water (fluid)	20 ounces	or	1000 c. c.
Bi-carbonate of potash	20 grains	,,	2 grammes.
Gold	2 ,,	,,	0·2 ,,

NEGATIVE INTENSIFIERS.

MONCKHOVEN'S.

1. A. Bromide of potassium............	10 grains or	23 grammes.
Bichloride of mercury	10 ,, ,,	23 ,,
Water	1 ounce ,,	1000 c. c.
B. Pure cyanide of potassium	10 grains or	23 grammes.
Nitrate of silver	10 ,, ,,	23 ,,
Water	1 ounce ,,	1000 c. c.

Place the negative in A till it is white, then rinse and transfer it to solution B. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

MERCURY AND AMMONIA.

Pour over the negative a saturated solution of mercuric chloride bichloride of mercury); do not keep it on too long, unless the negative is very thin. Wash well, and immerse in bath of—

Water	10 ounces or	1000 c. c.
Ammonia	10 minims ,,	21 ,,

Leave the plate in this solution until the black colour goes quite through the film.

MERCURY WITH SODIUM SULPHITE.

Whiten the negative in the saturated solution of mercuric chloride, wash and blacken with a solution of sulphite of sodium 1 in 5.

IODIDE OF MERCURY.

Dissolve one drachm (14 grammes) of bichloride of mercury in seven ounces (700 c. c.) of water, and three drachms (42 grammes) of iodide of potassium in three ounces (300 c. c.) of water, and pour the iodide solution into the mercury till the red precipitate formed is completely dissolved.

For use, dilute with water, flow over the negative till the proper density is reached, and wash, when the deposit will turn yellow. Remove the yellow colour by flowing a five per cent. solution of hypo over the plate, and give it the final washing.

URANIUM.

Uranium nitrate	12 grains or	7 grammes,
Potassium ferricyanide	15 ,, ,,	9 ,,
Water .... (fluid)	4 ounces ,,	1000 c. c.

Before using this intensifier, great care is necessary that every trace of hypo is dissolved from the film, or red fog will result.

FERRICYANIDE OF LEAD.

The negative, after washing, is placed in a solution made as follows:—

Lead nitrate	20 grains or	46 grammes.
Ferricyanide of potassium	30 ,, ,,	69 ,,
Distilled water	1 ounce ,,	1000 c. c.

After this it is again thoroughly washed until the drainings from the plate give a scarcely perceptible blue colour with ferrous-sulphate solution, and then ammonium sulphide (one part to ten parts of water) is poured over it.

BROMIDE OF COPPER.

A.	Potassium bromide	180 grains or	41 grammes.
	Water	10 ounces ,,	1000 c. c.
B.	Cupric sulphate	240 grains or	55 grammes.
	Water	10 ounces ,,	1000 c. c.

Mix the solutions, and, after standing a few hours, decant or filter out any potassium sulphate that may be precipitated. The solution will keep indefinitely, and may be used over and over again.

The *modus operandi* of intensification is the same as with the mercuric salt. The darkening or rendering sufficiently opaque of the deposit can be done by a solution of ammonia in water—say, water, 10 ounces; stronger solution of ammonia, 1 drachm. The application of any old developer will bring about the same result.

LUMIÈRE'S MERCURIC IODIDE INTENSIFIER.

Composition of Normal Intensifier.

Water	100 parts.
Anhydrous sulphite of soda	10 ,,
Mercuric iodide	1 part.

Instructions for Use.—Dissolve the anhydrous sulphite of soda in the water, then add the mercuric iodide. After intensification in the above solution, the image is washed and then treated with an alkaline developer, such as is used for ordinary negative work.

NEGATIVE REDUCERS.

FARMER'S.

Saturated solution of ferridcyanide of potassium	1 part or	100 c. c.
Hyposulphite of soda solution, 1 : 5.	10 parts ,,	1000 ,,

L. BELITZKI'S.

Potassium ferric oxalate	1 to 10 grains or	2 to 23 grammes.
Hyposulphite of soda solution, 1 : 5.	1 ounce ,,	1000 c. c.

CYANIDE REDUCING SOLUTION.

Cyanide of potassium	20 grains or	5 grammes.
Iodide of potassium	10 ,, ,,	2 ,,
Bichloride of mercury	10 ,, ,,	2 ,,
Water	10 ounces ,,	1000 c. c.

Reduction takes place slowly and is easy to control. After reducing, the negative should be washed thoroughly.

Perchloride of iron	30 grains or	3·4 grammes.
Citric acid	60 ,, ,,	6·8 ,,
Water	1 pint ,,	1000 c. c.

ORTHOCHROMATIC PROCESSES.

F. E. IVES'S.

Use any good bromide collodion emulsion that contains no free nitrate of silver. Flow plate as usual, and, as soon as the emulsion film sets, flow several times with strong alcoholic solution of chlorophyl from blue myrtle or plantain leaves, then immerse in water strongly tinted with blue shade eosine, and keep in motion until smooth.

Sensitises for all colours, including deep ruby red. A very light yellow screen is sufficient to secure correct rendering of colour tone.

V. SCHUMANN'S (GELATINE PLATES).

Soak the plate in 200 c. c. of water and 2 to 4 c. c. of ammonia for two to three minutes, then immerse in

Distilled water	200 c. c.
Alcohol	10 ,,
Ammonia	4 ,,
Alcoholic solution of cyanine, 1 : 500	10 ,,

DRS. MALLMANN AND SCOLIK'S (GELATINE PLATES).

Preliminary Bath.

A.	Water	200 c. c.
	Ammonia	2 ,,

Soak the plate for two minutes.

Colour Bath.

Erythrosine solution, 1·1000	25 c. c.
Ammonia	4 ,,
Water	175 ,,

The plate should not remain longer in this bath than one and a quarter minute. A longer time depresses the general sensitiveness.

Alcohol	500 c. c.
Chinoline red	1 gramme.

To which are added 50 c. c. of a solution of—

Alcohol	500 c. c.
Chinoline blue (cyanine)	1 gramme.

OBERNETTER'S FORMULA.

Distilled water	480 c. c.	=	16 fluid ounces.
Nitrate of silver	1·25 gramme	=	18 grains.
Ammonium carbonate	5 ,,	=	75 ,,
Erythrosine solution (1 in 500)	35 c. c.	=	1½ fluid ounces.
Strong ammonia	4 c. c.	=	1 drachm.

Bathe the plate in the preliminary solution (Mallmann and Scolik's formula) for 150 seconds.

Without washing, flow the sensitising solution over the plate twice, and dry in the dark closet.

HYPO ELIMINATORS, CLEARING SOLUTIONS, &c.

TO RESTORE FADED NEGATIVES.

Mr. W. E. Debenham recommends the following solution for the purpose of restoring printing force to negatives which have faded after mercurial intensification:—

Schlippe's salt	10 grains	or	23 grammes.
Water	1 ounce	,,	1000 c. c.

Wet the film thoroughly by soaking in a dish of water, and immerse in the restoring solution until the desired effect is obtained.

TO REMOVE THE LAST TRACES OF HYPO FROM THE FILM.

Hydroxyl.

Peroxide of hydrogen (twenty vols.)	1 drachm or	25 c. c.
Water	5 ounces ,,	1000 ,,

After washing the negative well it is immersed for a couple of minutes in the solution and again rinsed in water, when the intensification with silver can be at once proceeded with.

Another.

Where peroxide of hydrogen is not obtainable the following may be used as a substitute, the solution containing that substance in combination with others:—

Barium dioxide	1 ounce or	250 grammes.
Glacial acetic acid	1 ,, ,,	250 ,,
Water	4 ounces ,,	1000 c. c.

Reduce the barium dioxide to a fine powder and add it gradually to the acid and water, shaking until dissolved. A few minutes' immersion in this solution will effectually remove or destroy the last traces of hypo.

Alum.

A simple plan brought forward by Captain Abney for this specific purpose consists in employing a saturated solution of alum in place of the solution of hydroxyl or peroxide of hydrogen.

Eau de Javelle, or Labarraque's Solution.

Dry chloride of lime (hypochlorite of lime)	2 ounces or	50 grammes.
Carbonate of potash	4 ,, ,,	100 ,,
Water	40 ,, ,,	1000 c. c.

Mix the chloride of lime with thirty ounces of the water; dissolve the carbonate of potash in the remainder. Mix, boil, and filter.

CLEARING SOLUTIONS.

Alum	2 ounces or	200 grammes.
Citric acid	1 ounce ,,	100 ,,
Water	10 ounces ,,	1000 c. c.

Wash moderately after fixing, and immerse the negative in the above.

Another.

Saturated solution of alum	20 ounces or	1000 c. c.
Hydrochloric acid (commercial)	1 ounce ,,	50 ,,

Immerse the negative after fixing, having previously washed it for two or three minutes under the tap; wash well after removal from the alum and acid.

NEGATIVE VARNISHES, FORMULÆ FOR.

No. 1.	Sandarac	4 ounces	or	143 grammes.
	Alcohol	28 ,,	,,	1000 c. c.
	Oil of lavender	3 ,,	,,	107 ,,

This is a good varnish for retouching upon, as a 'tooth is easily obtained by rubbing.'

No. 2.	White hard varnish	15 ounces	or	150 c. c.
	Methylated alcohol	20 to 30 ,,	,,	200 to 300 c. c.

This will be found a good and cheap varnish if durability is not required, as it is easily rubbed up for retouching upon and easily cleaned off. Very suitable for enlarged negatives that are not to be retained.

Tough, hard, and durable :—

No. 3.	Bleached shellac	1¼ ounce	or	62 grammes.
	Mastic	¼ ,,	,,	13 ,,
	Oil of turpentine	¼ ,,	,,	13 c. c.
	Sandarac	1¼ ,,	,,	62 grammes.
	Alcohol	20 fluid ounces	,,	1000 c. c.

No. 4.	Sandarac	80 ounces	or	160 grammes.
	Turpentine	36 ,,	,,	72 c. c.
	Oil of lavender	10 ,,	,,	20 ,,
	Alcohol	500 ,,	,,	1000 ,,

This one may be rubbed down with powdered resin, and gives a splendid surface for retouching :—

No. 5.	Sandarac	1 ounce	or	55 grammes.
	Seed lac	1½ ,,	,,	85 ,,
	Castor oil	3 drachms	,,	2 c. c.
	Oil of lavender	1½ drachm	,,	1 ,,
	Alcohol	18 fluid ounces	,,	1000 c. c.

This varnish is somewhat dark in colour.

No. 6.	Best orange shellac	2½ ounces	or	125 grammes.
	Oil of lavender or oil of turpentine	¼ ounce	,,	13 c. c.
	Methylated alcohol	1 pint	,,	1000 ,,

Keep in a warm place until dissolved; then add a large teaspoonful of whiting or prepared chalk; shake, set aside to clear, and then decant. This is specially recommended for gelatine negatives.

Retouching Varnish.

Sandarac	1 ounce	or	167 grammes.
Castor oil	80 grains	,,	31 ,,
Alcohol	6 ounces	,,	1000 c. c.

First dissolve the sandarac in the alcohol, and then add the oil.

In the above formulæ the proportions of alcohol must be taken as approximate, as different samples of resins vary, some giving more viscous solutions than others.

GROUND-GLASS VARNISH.

Sandarac	90 grains	or	103 grammes.
Mastic	20 ,,	,,	23 ,,
Ether	2 ounces	,,	1000 c. c.

Dissolve the resins in the ether and afterwards add

Benzole .... ½ to 1½ ounce (250 to 750 c. c.).

The proportion of the benzole added determines the nature of the matt obtained.

THE WET-COLLODION PROCESS.

PYROXYLINE (Hardwich).

Sulphuric acid 1·845	(fluid) 18 ounces	or	600 c. c.
Nitric acid 1·457	,, 6 ,,	,,	200 ,,
Water	(fluid) 5 to 5¼ ,,	,,	167 to 182 c. c.
Cotton-wool	300 grains	,,	23 grammes.

Temperature 150° Fahr. (66° C.) Time of immersion, 10 minutes.

IODISED COLLODION (for Negatives).

For Acid Pyro Developer.

Ether, s.g. ·725	10 fluid ounces	or	1000 c. c.
Alcohol, s.g. ·805	4 ,,	,,	400 ,,
Pyroxyline	120 grains	,,	27 grammes.
Iodide of ammonium	30 ,,	,,	7 ,,
,, cadmium	45 ,,	,,	10 ,,
Alcohol ·830	4 fluid ounces	,,	400 c. c.

BROMO-IODISED COLLODION (for Negatives).

Iron Developer.

Ether, s.g. ·725	10 fluid ounces	or	1000 c. c.
Alcohol, s.g. ·805	5 ,,	,,	500 ,,
Pyroxyline	120 grains	,,	27 grammes.
Iodide of ammonium	40 ,,	,,	9 ,,
,, cadmium	40 ,,	,,	9 ,,
Bromide of ,,	20 ,,	,,	4·5 ,,
Alcohol ·830	5 fluid ounces	,,	500 c. c.

BROMO-IODISED COLLODION (for Positives or Ferrotypes).

Ether, s.g. ·725	10 fluid ounces	or	1000 c. c.
Alcohol, s.g. ·805	5 ,,	,,	500 ,,
Pyroxyline	100 grains	,,	23 grammes.
Iodide of cadmium	50 ,,	,,	11½ ,,
Bromide of ammonium	25 ,,	,,	5·7 ,,
Alcohol ·830	5 fluid ounces	,,	500 c. c.

Note.—The iodides should be dissolved in the weaker spirit and the roxyline in the ether and stronger spirit, and the two solutions mixed.

THE NITRATE BATH (for Negatives)

Nitrate of silver (recrystallised)	6 ounces	or	75 grammes.
Distilled water	80 fluid ounces	,,	1000 c. c.
Nitric acid (pure)	8 minims	,,	0·2 ,,

Saturate with iodide of silver, then filter.

This is best done by coating a plate with collodion and leaving it in the bath for some hours.

(For Positives or Ferrotypes.)

Nitrate of silver (recrystallised)	5½ ounces	or	70 grammes.
Distilled water	80 fluid ounces	,,	1000 c. c.
Nitric acid (pure)	½ drachm	,,	0·8 ,,

Saturate with iodide of silver and filter as above.

DEVELOPER.

FOR NEGATIVES.

No. 1.	Ferrous sulphate	½ ounce	or	50 grammes.
	Glacial acetic acid	½ ,,	,,	50 c. c.
	Alcohol	½ ,,	,,	50 ,,
	Water	10 ounces	,,	1000 ,,
No. 2.	Ammonio-sulphate of iron	75 grains	or	43 grammes.
	Glacial acetic acid	75 ,,	,,	43 ,,
	Sulphate of copper	7 ,,	,,	4 ,,
	Water	4 ounces	,,	1000 c. c.
	Alcohol	¼ ounce	,,	60 ,,

FOR COLLODION POSITIVES OR FERROTYPES.

Ferrous sulphate	150 grains	or	34 grammes.
Glacial acetic acid	½ ounce	,,	50 c. c.
Nitric acid	5 minims	,,	1 ,,
Alcohol	½ ounce	,,	50 ,,
Water	10 ounces	,,	1000 ,,

Note.—By increasing the proportion of nitric acid and decreasing that of the acetic, the image will be more metallic in appearance.

Nitrate of Iron Developer for Positives.

Ferrous sulphate	1½ ounce	or	75 grammes.
Nitrate of baryta	1 ,,	,,	50 ,,
Water	1 pint	,,	1000 c. c.
Alcohol	1 ounce	,,	50 ,,
Nitric acid	40 drops	,,	4 ,,

The insoluble sulphate of baryta which is formed must be filtered out.

Fixing Solution for Positives.

Cyanide of potassium	½ ounce	or	25 to 30 grammes.
Water	15 to 20 ounces	,,	1000 c. c.

For Collodion Transfers.

Pyrogallic acid	5 grains	or	11 grammes.
Citric acid	3 ,,	,,	7 ,,
Acetic acid	20 minims	,,	41 c. c.
Water	1 ounce	,,	1000 ,,
Alcohol	20 minims	,,	41 c. c.

PYROXYLINE FOR DRY-COLLODION PROCESSES.

For Collodio-bromide or Unwashed Emulsion.

Nitric acid, s.g. 1·45	2 fluid ounces	or	285 c. c.
Sulphuric acid, s.g. 1·845	4 ,,	,,	570 ,,
Water	1 fluid ounce	,,	145 ,,
Cotton (cleaned and carded)	100 grains	,,	33 grammes.
Temperature	150° Fahr.	,,	65° C.
Time of immersion	10 minutes.		

For Washed Emulsion.

Nitric acid, s.g. 1·45	2 fluid ounces	or	400 c c.
Sulphuric acid, s.g. 1·845	3 ,,	,,	600 ,,
White blotting-paper	145 grains	,,	66 grammes.
Temperature	100° Fahr.	,,	38° C.
Time of immersion	30 minutes.		

THE COLLODIO-BROMIDE PROCESS.

COLLODIO-BROMIDE EMULSION.

Ether, s.g. ·720	5 fluid ounce	or	620 c. c.
Alcohol, s.g. ·820	3 ,,	,,	380 ,,
Pyroxyline	50 grains	,,	14·3 grammes.
Bromide of cadmium and ammonium	80 ,,	,,	23 ,,
or Bromide of zinc	76 ,,	,,	21·5 ,,

Sensitise by adding to each ounce fifteen grains of nitrate of silver, dissolved in a few drops of water and one drachm of boiling alcohol. This is suitable for slow landscape work or for transparencies.

Washed Emulsion (for Landscapes).

No. 1.

Ether, s.g. ·720	4 fluid ounces	or 590 c. c.
Alcohol, s.g. ·820	2¾ ,,	,, 410 ,,
Pyroxyline	40 grains	,, 13·5 grammes.
Castile soap (dissolved in alcohol)	30 ,,	,, 10 ,,
Bromide of ammonium and cadmium	84 ,,	,, 27·3 ,,

Sensitise with one hundred grains of nitrate of silver dissolved in one ounce of boiling alcohol; and, after standing ten days, add a further twenty grains of silver dissolved as before in two drachms of alcohol.

No. 2 (rapid).

Ether, s.g. ·720	4 fluid ounces	or 615 c. c.
Alcohol, s.g. ·820	2¼ ,,	,, 215 ,,
Pyroxyline	40 grains	,, 14 grammes.
Castile soap	30 ,,	,, 10·5 ,,
Bromide of ammonium and cadmium	56 ,,	,, 20 ,,

Sensitise with 125 grains of nitrate of silver, dissolved, as before, in one ounce of alcohol with the aid of heat. In twelve hours' time add thirty grains more of the double bromide of ammonium and cadmium dissolved in half an ounce of alcohol.

For Washed Emulsion (for Transparencies).

Ether, s.g. ·720	5 fluid ounces	or 620 c. c.
Alcohol, s.g. ·820	3 ,,	,, 380 ,,
Pyroxyline or papyroxyline	60 grains	,, 17 grammes.
Bromide of cadmium and ammonium	100 ,,	,, 29 ,,
or Bromide of zinc	96 ,,	,, 27·5 ,,
Hydrochloric acid, s.g. 1·2	8 minims	,, 2 c. c.

Sensitise with twenty grains of nitrate of silver to each ounce (4·3 grammes to each 100 c.c.), dissolved in a minimum of water with two drachms (13 c.c.) of boiling alcohol. Allow to stand for two or three days.

N.B.—In the three last formulæ, the emulsion, after being allowed to ripen for the time stated, should be poured into a dish and allowed to become thoroughly dry. The mass of dry emulsion is then washed, to remove all the soluble salts, and is then again dried and redissolved in equal parts of ether and alcohol, at the rate of from twenty to twenty-four grains to the ounce of solvents.

DEVELOPING SOLUTIONS FOR COLLODION EMULSION.

Solution A.

Pyrogallic acid	96 grains	or 22 grammes.
Alcohol	1 fluid ounce	,, 100 c. c.

Solution B.

Bromide of potassium ...	10 grains	or 23 grammes.
Water	1 fluid ounce	,, 1000 c. c.

Solution C.

Liquor ammoniæ, s.g. ·880	1 fluid drachm	or 60 c. c.
Water	15 fluid drachms	,, 940 ,,

or D.

Carbonate of ammonium	120 grains	or 275 grammes.
Water	1 fluid ounce	,, 1000 c. c.

For each drachm (100 c. c.) of developer take, for a normal exposure, five minims (8½ c. c.) of A, one or two minims (about 3 c. c.) of B, and the same of C; or, if D be used, add the above quantities of A, B, and C, to one drachm (100 c. c.) of D. When the details of the image are out, add double the quantities of B and C.

WELLINGTON'S COLLODIO-BROMIDE EMULSION FORMULÆ.

Pyroxyline	30 grains	or 23 grammes.
Ether	12 drachms	,, 500 c. c.
Alcohol	12 ,,	,, 500 ,,

To bromise, add 30 grains (23 grammes) bromide ammonium dissolved in 45 minims (31 c. c.) water, to which 4 drachms (170 c. c.) of alcohol are afterwards added; 50 grains (33 grammes) of nitrate of silver dissolved in a drachm (4½ c. c.) of water are then added. After washing and drying, the pellicle is dissolved in 1¾ ounces (580 c. c.) of ether and the same of alcohol.

Developer.

No. 1.	Pyrogallic acid	1 ounce	or 56 grammes.
	Sulphite of soda	4 ounces	,, 224 ,,
	Water	18 ,,	,, 1000 c. c.
No. 2.	Potassium carbonate	3 ounces	or 166 grammes.
	Sulphite of soda	2 ,,	,, 112 ,,
	Water	18 ,,	,, 1000 c. c.
No. 3.	Bromide ammonium	1 ounce	or 100 grammes.
	Water	10 ,,	,, 1000 c. c.

Use equal parts of each without dilution.

NESBIT'S FORMULÆ.

Pyroxyline	60 grains	or 27·5 grammes.
Methylated alcohol	2¾ ounces	,, 550 c. c.
Ether	2¼ ,,	,, 450 ,,
Bromide ammonium (in water 100 minims, 200 c.c.)	63 grains	,, 28 grammes.
Alcohol	1 ounce	,, 200 c. c.
Nitrate of silver........................	100 grains	,, 46 grammes.
Water	60 minims	,, 25 c. c.

After washing and drying, redissolve in alcohol 4 ounces, ether 4 ounces (800 c. c.)

INTENSIFYING SOLUTIONS FOR COLLODION EMULSION.

Nitrate of silver	60 grains	or	68 grammes.
Citric acid	30 ,,	,,	31 ,,
Nitric acid	30 minims	,,	31 c. c.
Water	2 ounces	,,	1000 ,,

To each drachm of a three-grain solution of pyrogallic acid add two or three minims of the above, and apply until sufficient density is attained.

MISCELLANEOUS FORMULÆ.

THE 'DUSTING-ON' PROCESS.

No. 1.	Saturated solution of bichromate of ammonium	5	drachms or grammes.
	Honey	3	,, ,, ,,
	Albumen	3	,, ,, ,,
	Distilled water	20 to 30	,, ,, c.c.
No. 2.	Dextrine	½	ounce or 5 grammes.
	Grape sugar	½	,, ,, ,,
	Bichromate	½	,, ,, ,,
	Water	½	pint = 10 ounces or 100 c.c.
No. 3.	Gum arabic	6	parts or grammes.
	Bichromate of potash	2·5	,, ,, ,,
	Grape sugar	4	,, ,, ,,
	Water	72	,, ,, c.c.

SILVERING MIRRORS (MARTIN'S METHOD).

(*In employing the following formulæ, it should be well understood that the glass plate to be silvered must be scrupulously clean.*)

A.	Nitrate of silver	175 grains	or	40 grammes.
	Distilled water	10 ounces	,,	1000 c. c.
B.	Nitrate of ammonium	262 grains	or	60 grammes.
	Distilled water	10 ounces	,,	1000 c. c.
C.	*Pure* caustic potash	1 ounce	or	100 grammes.
	Distilled water	10 ounces	,,	1000 ,,
D.	Pure sugar candy	½ ounce (avoird.)	or	100 grammes.
	Distilled water	5 ounces	,,	1000 c. c.

Dissolve and add—

Tartaric acid .... 50 grains or 23 grammes.

Boil in a flask for ten minutes, and when cool add—

Alcohol .... 1 ounce or 200 c. c.

Distilled water *quant. suff.* to make up to 10 ounces or 2000 c. c.

For use take equal parts of A and B. Mix together also equal parts of C and D, and mix in another measure. Then mix both these mixtures together in the silvering vessel, and suspend the mirror face downward in the solution.

INK FOR RUBBER STAMPS.

Aniline red (violet)	90 grains	or	206 grammes.
Boiling distilled water......	1 ounce	,,	1000 c. c.
Glycerine	half a teaspoonful	,,	60 ,,
Treacle	half as much as glycerine	,,	30 ,,

TO RECOVER FOGGED PLATES.

Make a solution as follows :—

Chromic acid	30 grains	or	7 grammes.
Bromide of potassium............	60 ,,	,,	14 ,,
Water................................	10 ounces	,,	1000 c. c.

And immerse the plates for five minutes. Afterwards wash very thoroughly, and rear up to dry.

Or, instead of the above, make the following :—

Bichromate of potash	1 ounce	or	100 grammes.
Hydrobromic acid...............	2 drachms	,,	25 ,,
Water	10 ounces	,,	1000 c. c.

If hydrobromic cannot be obtained, use hydrochloric acid or a soluble bromide ; in the last case a few drops of sulphuric acid being added to the solution. Use as before.

SOLUTION FOR MOUNTING PRINTS WITHOUT THEIR COCKLING.

Nelson's No. 1 photo. gelatine	4 ounces	or	182 grammes.
Water	16 ,,	,,	728 c. c.
Glycerine	1 ounce	,,	45 ,,
Methylated alcohol.............	5 ounces	,,	227 ,,

Dissolve the gelatine in the water, then add the glycerine, and lastly the spirit.

ENCAUSTIC PASTE.

Pure wax	500	parts or	grammes.
Gum elemi	10	,, ,,	,,
Benzole...................................	200	,, ,,	c. c.
Essence of lavender	300	,, ,,	,,
Oil of spike	15	,, ,,	,,

BACKING SHEETS FOR DRY PLATES.

Gelatine	1 part	or	50 grammes.
Water	2 parts	,,	100 c. c.
Glycerine	1 part	,,	50 ,,
Indian ink	A small addition.		

Make a paste, and coat strong paper; place the prepared material, face downwards, on waxed glass to set. Press to back of plate before putting into dark slide.

SENSITISING SOLUTION FOR CARBON TISSUE.

Bichromate of potash	1 ounce	or	350 to 500 grammes.
Water	20 to 30 ounces	,,	1000 c. c.
Liquor ammoniæ	20 minims	,,	1·5 to 2 c. c.

A strong solution should be used for hard negatives and a more dilute one for soft negatives.

WAXING SOLUTION.

For Carbon Prints, or for Removing Collodion Films.

No. 1.	Beeswax	20 grains	or	10 grammes.
	Benzole rect. No. 1	4 ounces	,,	1000 c. c.

For Flexible Supports (Autotype).

No. 2.	Yellow resin	3 drachms	or	41 grammes.
	Yellow beeswax	1 drachm	,,	14 ,,
	Rectified spirits of turpentine	10 ounces	,,	1000 c. c.

ALBUMEN PROCESS FOR TRANSPARENCIES.

Iodised Albumen.

Albumen	10 ounces	or	1000 c. c.
Liquor ammoniæ	½ drachm	,,	6 ,,
Iodide of ammonium	50 grains	,,	11 grammes.
Bromide of ammonium	10 ,,	,,	2 ,,

Silver Bath.

Water	10 ounces	or	1000 c. c.
Nitrate silver	1 ounce	,,	100 grammes.
Glacial acetic acid	1 ,,	,,	100 ,,

Coat the glass with old iodised collodion and when it has set wash under the tap, drain, and coat with the albumen. When dry, sensitise for 1 minute, wash, and again dry.

Developer.

Pyrogallic acid	30 grains	or	7 grammes.
Citric acid	20 ,,	,,	4·5 ,,
Water	10 ounces	,,	1000 c. c.

Use warm (120° Fahr. or 49° C.) and add 2 or 3 drops of a solution of 20-grain per ounce nitrate of silver (5 per cent.) at the time of using. Fix in a solution of hyposulphite of soda 4 ounces to the pint (20 per cent.). Tone with gold if the colour is too brown.

LUBRICANT FOR BURNISHING PRINTS.

Castile soap......................	20 grains	or	4 grammes.
Alcohol	10 ounces	,,	1000 c. c.

BACKING FOR DRY PLATES TO PREVENT HALATION (Teape's).

Gum solution (ordinary office gum) ...	1	ounce or part.
Caramel	1	,, ,,
Burnt sienna, ground in water	2	ounces or parts.
Mix and add alcohol..........................	2	,, ,,

COLOUR FOR APPLYING TO BRIGHT MACHINERY PRIOR TO PHOTOGRAPHING IT.

Mix white lead with turpentine to the consistence of thin cream, with sufficient lamp-black to form a light slate colour, and then add one-sixth the bulk of japanners' gold size. Paint the machinery over with this. After the photograph has been taken, the colour can be quickly removed with a pledget of 'cotton waste' moistened with turpentine or benzoline.

RETOUCHING MEDIUM.

Pale resin..	1	ounce or parts.
Oil of turpentine..................................	1	,, ,, ,,
Oil of lavender	2	ounces ,, ,,

TO PREVENT BLISTERS IN ALBUMEN PRINTS.

Before wetting the prints immerse them in methylated spirit, then wash and tone as usual.

TO REMOVE GELATINE NEGATIVES FROM THE GLASS.

Immerse the plate in water to which a few drops per ounce of hydrofluoric acid have en added. If the film expands, as most likely it will, mmersion in spirit will bring it to its original dimensions.

PRINTING ON PLAIN PAPER.

Prepare the plain paper with

Ammonium chloride	60 to 80	grains	or	14 to 18 grammes.
Sodium citrate	100	,,	,,	23 ,,
Sodium chloride	20 to 30	,,	,,	5 to 7 ,,
Gelatine	10	,,	,,	2 ,,
Distilled water	10	ounces	,,	1000 c. c.

or, Ammonium chloride	100 grains	or	23 grammes.
Gelatine	10 ,,	,,	2 ,,
Water	10 ounces	,,	1000 c. c.

The gelatine is first swelled in cold water and then dissolved in hot water, and the remaining components of the formula are added. The solution is filtered, and, when still warm, the paper floated upon it for three minutes.

The salted paper is sensitised upon a neutral 45-grain silver bath.

PLATINUM TONING BATH FOR PLAIN SILVER PRINTS.

Chloroplatinite of potassium	1 gramme.
Water	1 litre.
Nitric acid	5 to 10 drops.

INVISIBLE INK.

Chloride of cobalt	50 grains	or	11·4 grammes.
Distilled water	1 fluid ounce	,,	1000 c. c.
Glycerine	10 minims	,,	21 ,,

Dissolve the chloride of cobalt in the distilled water, and add the glycerine.

Writing executed with this ink is invisible on paper, but, on warming, the writing turns blue. On exposure to damp air it becomes invisible again.

SOLUTION FOR MAKING PAPER ADHERE TO METAL.

Tragacanth	30 grammes.
Gum arabic	120 ,,
Water	500 c. c.

DEVELOPING VALUE OF THE ALKALIES.

THE LATE W. B. BOLTON'S TABLE.

Caustic soda.	Caustic Potash.	Ammonia NH$_3$.	Carbonate of Soda (anhydrous).	Carbonate of Soda (cryst.).	Carbonate of Potash (anhydrous).	Carbonate of Potash (cryst.).	Sesquicarbonate of Ammonia.
1	1·400	0·425	2·650	7·150	3·450	4·350	7·250
0·714	1·	0·304	1·893	5·170	2·464	3·107	5·178
2·353	3·294	1·	6·235	16·823	8·117	10·235	17·057
0·377	0·528	0·160	1·	2·698	1·301	1·641	2·736
0·140	0·196	0·059	0·370	1·	0·482	0·608	1·014
0·290	0·405	0·123	0·768	2·072	1·	1·261	2·101
0·230	0·322	0·098	0·609	1·644	0·793	1·	1·666
0·138	0·193	0·059	0·365	0·986	0·476	0·600	1·

CHEMICAL EQUIVALENCE OF THE ALKALIES.

MR. G. E. BROWN'S TABLE.

Caustic Soda.	Caustic Potash.	Ammonia (·880 solution).	Carbonate of Soda (anhydrous).	Carbonate of Soda (cryst.).	Carbonate of Potash (anhydrous).	Carbonate of Potash (cryst.).	Sesquicarbonate of Ammonia.
80	112	97·14	106	286	138	174	12
1	1·400	·867	1·325	3·575	1·725	2·174	1·587
·714	*1*	1·211	·946	2·553	1·232	1·554	1·134
·834	1·153	*1*	1·091	2·944	1·421	1·791	1·307
·755	1·033	·916	*1*	2·698	1·302	1·641	1·198
·280	·392	·340	·371	*1*	·483	·608	·444
·580	·812	·704	·768	2·072	*1*	1·260	·920
·460	·644	·558	·609	1·644	·793	*1*	·730
·630	·882	·765	·835	2·252	1·087	1·370	*1*

TABLES FOR THE SIMPLIFICATION OF EMULSION CALCULATIONS.

With a view of simplifying the calculations involved in emulsion-making, the late Mr. William Ackland a few years ago worked out some useful tables, which will enable even those most ignorant of chemical philosophy to calculate with ease and rapidity the proper quantities of silver or haloid salts in any formula. Even those who are able to perform the calculations in the recognised style will find their labours materially lightened by means of these tables, which should be kept in a convenient place for reference in every laboratory.

No. I.

	Equivalent weights.	Weight of $AgNO_3$ required to convert one grain of soluble haloid.	Weight of soluble haloid required to convert one grain $AgNO_3$.	Weight of *silver* haloid produced by one grain of *soluble* haloid.	Weight of *soluble* haloid required to produce one grain of *silver* haloid.	Weight of silver haloid produced from one grain $AgNO_3$.
Ammonium bromide	98	1·734	·576	1·918	·521	1·106
Potassium ,, ...	119·1	1·427	·700	1·578	·633	
Sodium ,, ...	103	1·650	·606	1·825	·548	
Cadmium ,, com.	172	·988	1·012	1·093	·915	
,, ,, anh.	136	1·25	·800	1·382	·723	
Zinc ,, ...	112·1	1·509	·663	1·670	·600	
Ammonium chloride	53·5	3·177	·315	2·682	·373	·844
Sodium ,, ...	58·5	2·906	·344	2·453	·408	
Ammonium iodide	145	1·172	·853	1·620	·617	1·382
Potassium ,, ...	166·1	1·023	·977	1·415	·707	
Sodium ,, ...	150	1·133	·882	1·566	·638	
Cadmium ,, ...	183	·929	1·076	1·284	·778	

The principal bromides, chlorides, and iodides which are likely to be used in emulsions of either gelatine or collodion have been included in these tables. Table No. I. presents to the reader, without any mystification which may be involved in equivalents, the actual weights of haloid or silver, as the case may be, required to convert or combine with one grain of the other.

In order to test the utility of this table, let us suppose that it is desired to make (say) ten ounces of emulsion by a new formula, which, for the sake of showing the working of the table, we will write down as follows :—

Bromide of potassium	150 grains.
Iodide of potassium	10 ,,
Chloride of ammonium	10 ,,
Gelatine	200 ,,

Now we want to know how much silver nitrate should be employed in sensitising this mixture. For this purpose we use the first column, in which we find against each haloid the exact quantity of silver nitrate required to fully decompose one grain. Taking, then, the figures we find in column No. 1 against the three salts in the above formula, and multiplying them by the number of grains of each used, we have the following sum :—

Potassium bromide	150 × 1·427 = 214	Weight silver nitrate required,
,, iodide	10 × 1·023 = 10·23	
Chloride of ammonium ...	10 × 3·177 = 31·77	

or the total quantity of silver nitrate required for full conversion, 256·00 grains.

No. II.

	Ammonium Bromide.	Potassium Bromide.	Sodium Bromide.	Cadmium Bromide. (Coml.)	Cadmium Bromide. (Anhyd.)	Zinc Bromide.	Ammonium Chloride.	Sodium Chloride.	Ammonium Iodide.	Potassium Iodide.	Sodium Iodide.	Cadmium Iodide.
Ammonium bromide............	**1**	·823	·951	·57	·72	·87	1·832	1·675	·676	·59	·653	·535
Potassium „	1·215	**1**	1·156	·692	·876	1·058	2·226	2·036	·821	·717	·794	651
Sodium „	1·051	·865	**1**	·599	·757	·915	1.925	1·761	·71	·62	·686	·563
Cadmium „ com.	1·755	1·444	1·67	**1**	1·265	1·527	3·215	2·94	1·186	1·035	1·146	·94
„ „ anh.	1·387	1·141	1·32	·79	**1**	1·207	2·542	2·324	·938	·819	·906	·743
Zinc „	1·149	·945	1·093	·655	·828	**1**	2·104	1·925	·776	·678	·75	·615
Ammonium chloride..........	·546	·449	·519	·311	·393	·475	**1**	·914	·369	·322	·356	·292
Sodium „	·597	·491	·568	·34	·43	·519	1·093	**1**	·403	·352	·39	·319
Ammonium iodide.............	1·479	1·217	1·408	·843	1·066	1·287	2·712	2·478	**1**	·873	·966	·792
Potassium „	1·695	1·394	1·612	·965	1·221	1·475	3·104	2·839	1·145	**1**	1·107	·907
Sodium „	1·53	1·259	1·456	·872	1·103	1·332	2·803	2·564	1·034	·903	**1**	·819
Cadmium „	1·867	1·536	1·776	1·064	1·345	1·625	3·42	3·128	1·262	1·102	1·22	**1**

Table No. II. gives in separate columns the relative converting values of each of the soluble haloid salts in ordinary use, showing how much of any salt must be used to replace one grain of any other. In each column will be found a unit (printed in larger type) which represents one grain of the salt named at the head of the column; the other figures in the same column show the exact quantities of the other salts which must be used in lieu of a single grain of that particular haloid. Thus, taking the first column, which is headed 'Ammonium Bromide,' we find against ammonium bromide in the margin the figure 1, representing one grain of that salt. If we wish to know the relative converting power of potassium bromide we take the number in the same column which stands against the latter salt in the margin, viz., 1·215; that is to say, 1·215 grain of potassium bromide will be required to do the same work as one of NH_4Br.

SOLUBILITY OF THE SILVER HALOIDS.

By E. VALENTA.

In the *Royal Photographic Society's Journal* the following table, the result of a series of experiments, was given.

Solvent.	Concentration.	100 g. of solution can dissolve in grammes.			Remarks.
		Ag Cl.	Ag Br.	Ag I.	
Sodium hyposulphite	1 : 100	0·40	0·35	0·03	The estimations were made at 20° C.
„	5 : 100	2·00	1·90	0·15	
„	10 : 100	4·10	3·50	0·30	
„	15 : 100	5·50	4·20	0·40	
„	20 : 100	6·10	5·80	0·60	
Ammonium hyposulphite............	1 : 100	0·57	—	—	For bromide and iodide of silver similar results were obtained as with sodium hyposulphite.
„	5 : 100	1·32	—	—	
„	10 : 100	3·92	—	—	
Sodium sulphite........................	10 : 100	0·44	0·04	0·01	
„	20 : 100	0·95	0·08	0·02	
Ammonium sulphite	10 : 100		traces		
Ammonium carbonate	10 : 100	0·05	—	—	
Ammonia.................................	3%	1·40	—	—	
„	15%	7·58	—	—	
Magnesium chloride	50 : 100	0·50	—	—	
Potassium cyanide......................	5 : 100	2·75	6·55	8·23	25° C.
Ammonium sulphocyanide	5 : 100	0·08	0·21	0·02	23° C.
„	10 : 100	0·54	2·04	0·08	
„	15 : 100	2·88	5·30	0·13	
Potassium sulphocyanide............	10 : 100	0·11	0·73	—	25° C.
Calcium sulphocyanide...............	10 : 100	0·15	0·53	0·03	
Barium sulphocyanide	10 : 100	0·20	0·35	0·02	
Aluminium sulphocyanide	10 : 100	2·02	4·50	0·02	
Thiocarbamide	10 : 100	0·83	1·87	0·79	25° C.
Thiosinamin	1 : 100	0·40	0·08	0·008	
„	5 : 100	1·90	0·35	0·05	
„	10 : 100	3·90	0·72	0·09	

A TABLE OF ATOMIC WEIGHTS OF SEVENTY-FOUR ELEMENTS.

By T. W. Richards.

From the 'American Chemical Journal.'

Name.	Symbol.	Atomic Weight.
Aluminium	Al	27·1
Antimony	Sb	120·0
Argon	A	39·9 ?
Arsenic	As	75·0
Barium	Ba	137·43
Beryllium	Be = Gl	9·1
Bismuth	Bi	208·0
Boron	B	10·95
Bromine	Br	79·955
Cadmium	Cd	112·3
Cæsium	Cs	132·9
Calcium	Ca	40·0
Carbon	C	12·001
Cerium	Ce	140·0
Chlorine	Cl	35·455
Chromium	Cr	52·14
Cobalt	Co	59·00
Columbium	Cb = Nb	94·0
Copper	Cu	63·60
'Didymium'	Nd + Pr	142 ±
Erbium	Er	166·0
Fluorine	F	19·05
Gadolinium	Gd	156·0 ?
Gallium	Ga	70·0
Germanium	Ge	72·5
Glucinum	Gl = Be	9·1
Gold	Au	197·3
Helium	He	4·0 ?
Hydrogen	H	1·0075
Indium	In	114·0
Iodine	I	126·85
Iridium	Ir	193·0
Iron	Fe	56·0
Lanthanum	La	138·5
Lead	Pb	206·92
Lithium	Li	7·03
Magnesium	Mg	24·36
Manganese	Mn	55·02
Mercury	Hg	200·0

A TABLE OF ATOMIC WEIGHTS—CONTINUED.

NAME.	Symbol.	Atomic Weight.
Molybdenum	Mo	96·0
Neodymium	Nd	143·6
Nickel	Ni	58·70
Niobium	Nb=Cb	94·0
Nitrogen	N	14·045
Osmium	Os	190·8
Oxygen (Standard)	O	16·000
Palladium	Pd	106·5
Phosphorus	P	31·0
Platinum	Pt	195·2
Potassium	K	39·140
Praseodymium	Pr	140·5
Rhodium	Rh	103·0
Rubidium	Rb	85·44
Ruthenium	Ru	101·7
Samarium	Sm	150·0
Scandium	Sc	44·0
Selenium	Se	79·0
Silicon	Si	28·4
Silver	Ag	107·93
Sodium	Na	23·050
Strontium	Sr	87·68
Sulphur	S	32·065
Tantalum	Ta	183·0
Tellurium	Te	127·5
Terbium	Tb	160·0
Thallium	Tl	204·15
Thorium	Th	233·0
Thulium	Tu	170·0 ?
Tin	Sn	119·0
Titanium	Ti	48·17
Tungsten	W	184·4
Uranium	U	240·0
Vanadium	V	51·4
Ytterbium	Yb	173·0
Yttrium	Yt	89·0
Zinc	Zn	65·40
Zirconium	Zr	90·5

TABLE OF SYMBOLS AND EQUIVALENT WEIGHTS OF THE MORE IMPORTANT COMPOUNDS USED IN PHOTOGRAPHY.

NAME.	SYMBOL.	
Acetone	$CH_3\,CO\,CH_3$	58
Acid, Acetic	$CH_3\,COOH$	60
,, Boracic	$H_3\,BO_3$	62
,, Citric	$C_6\,H_8\,O_7+Aq$	210
,, Formic	$H\,COOH$	46
,, Gallic	$C_6\,H_2\,(OH)_3\,COOH$	188
,, Hydriodic	HI	128
,, Hydrobromic	$H\,Br$	81
,, Hydrochloric	$H\,Cl$	36·5
,, Hydrocyanic	$H\,CN$	27
,, Hydrosulphuric	$H_2\,S$	34
,, Nitric	$H\,NO_3$	63
,, Oxalic	$(COOH)_2+2\,Aq$	126
,, Pyrogallic	$C_6\,H_3\,(OH)_3$	126
,, Sulphuric	$H_2\,SO_4$	98
,, Sulphurous	$H_2\,SO_3$	82
,, Tannic	$C_{14}\,H_{10}\,O_9$	322
,, Tartaric	$C_2\,H_2\,OH_2\,(COOH)_2$	133
Alcohol (Methyl)	$CH_3\,OH$	32
,, (Ethyl)	$C_2\,H_5\,OH$	46
Alum (Chrome)	$K\,Cr\,(SO_4)_2\,12\,Aq$	499·3
,, Potash	$K\,Al\,(SO_4)_2+12\,Aq$	474·5
Amidol	$C_6\,H_3\,OH\,(NH_2)_2\,(H\,Cl)_2$	196
Ammonium, Bichromate	$(NH_4)_2\,Cr_2\,O_7$	53
,, Bromide	$NH_4\,Br$	298
,, Chloride	$NH_4\,Cl$	53·5
,, Iodide	$NH_4\,I$	145
,, Nitrate	$NH_4\,NO_3$	80
,, Oxalate	$(NH_4)_2\,C_2\,O_4$	124
,, Sulphide	$NH_4,\,HS$	51
,, Sulphocyanide	$NH_4,\,CNS$	76
Barium, Bromide	$Ba\,Br_2+2\,Aq$	333
,, Chloride	$Ba,\,Cl_2+2\,Aq$	244
,, Iodide	$Ba\,I_2+2\,Aq$	427
,, Nitrate	$Ba,\,(NO_3)_2$	261
Benzole	$C_6\,H_6$	78
Cadmium, Bromide	$Cd\,Br_2+4\,Aq$	344
,, Chloride	$Cd\,Cl_2+2\,Aq$	219
,, Iodide	$Cd\,I_2$	366
Calcium, Bromide (Cryst.)	$Ca\,Br_2+4\,Aq$	272
,, Chloride (Cryst.)	$Ca\,Cl_2+6\,Aq$	219
,, Iodide	$Ca\,I_2$	294
Copper, Bromide	$Cu\,Br_2$	223·5
,, Chloride ,,	$Cu\,Cl_2+2\,Aq$	170·5
,, Sulphate ,,	$Cu\,SO_4+5\,Aq$	249·5

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	
Eikonogen	$C_{10} H_5 OH (NH_2)_2 (H Cl)_2$	247
Formaline	$H CHO$	30
Glycerine	$C_3 H_5 (OH)_3$	92
Gold, Chloride	$Au Cl_3 + 2 Aq$	339·2
Hydroquinone	$C_6 H_4 (OH)_2$	110
Iridium, Perchloride	$Ir Cl_4$	335
Iron, Chloride (ferrous)	$Fe Cl_2 + 4 Aq$	199
,, ,, (ferric)	$Fe_2 Cl_6$	325
,, Citrate	$Fe_2 (C_6 H_5 O_7)_2$	598
,, Iodide	$Fe I_2 + 4 Aq$	382
,, Oxalate (ferrous)	$Fe C_2 O_4$	144
,, ,, (ferric)	$Fe_2 (C_2 O_4)_3$	376
,, Sulphate (ferrous)	$Fe SO_4 + 7 Aq$	278
,, ,, (ferric)	$Fe_2 (SO_4)_3$	400
,, Ammonia-sulphate	$Fe SO_4 (NH_4)_2 SO_4 + 6 Aq$	392
Lead, Acetate	$Pb (C_2 H_3 O_2)_2 + 3 Aq$	379
,, Nitrate	$Pb (NO_3)_2$	331
Lithium, Bromide	$Li Br$	87
,, Chloride	$Li Cl$	42·5
,, Iodide	$Li I$	134
Magnesium, Bromide	$Mg Br_2$	184
,, Chloride	$Mg Cl_2 + 6 Aq$	203
,, Iodide	$Mg I_2$	278
Mercury, Chloride (Mercuric)	$Hg Cl_2$	271
Metol	$C_6 H_4 OH CH_3 NH (H_2 SO_4)_2$	349
Para-amidophenol	$C_6 H_4 OH NH_2 HCl$	145
Platinum, Chloride (Platinic)	$Pt Cl_4 + 8 Aq$	483·4
,, ,, (Platinous)	$Pt Cl_2$	268·4
Potassium, Acetate	$K_2 C_2 H_3 O_2$	137
,, Bichromate	$K_2 Cr_2 O_7$	295
,, Bromide	$K Br$	119·1
,, Carbonate	$K_2 CO_3 + 2 Aq$	174
,, Chlorate	$K Cl O_3$	122·5
,, Chloride	$K Cl$	74·5
,, Citrate	$K_3 C_6 H_5 O_7 + Aq$	324·3
,, Cyanide	$K C N$	65
,, Ferridcyanide	$K_6 Fe_2 Cy_{12}$	658
,, Ferrocyanide	$K_4 Fe Cy_6 + 3 Aq$	422
,, Hydrate	$K OH$	56·1
,, Iodide	$K I$	166
,, Nitrate	$K NO_3$	101
,, Oxalate	$K C_2 O_4 + Aq$	235
,, Permanganate	$K_2 Mn_2 O_8$	316
,, Platino-chloride	$(K_2 Pt Cl_4)$	342·1
,, Sulphocyanide	$K Cy S$	97
Silver, Acetate	$Ag C_2 H_3 O_2$	167
,, Bromide	$Ag Br$	188

TABLES OF SYMBOLS, &c.—CONTINUED.

NAME.	SYMBOL.	
Silver, Carbonate	$Ag_2\,CO_3$	276
,, Chloride	$Ag\,Cl$	143·5
,, Citrate	$Ag_3\,C_6\,H_5\,O_7$	513
,, Fluoride	$Ag\,Fl$	127
,, Iodide	$Ag\,I$	235
,, Nitrate	$Ag\,NO_3$	170
,, Oxalate	$Ag_2\,C_2\,O_4$	304
,, Oxide	$Ag_2\,O$	232
,, Sulphide	$Ag_2\,S$	248
Sodium, Acetate	$Na\,C_2\,H_3\,O_2+3\,Aq$	136
,, Biborate (Borax)	$Na_2\,B_4\,O_7+10\,Aq$	382
,, Bichromate	$Na_2\,Cr_2\,O_7+2\,Aq$	299
,, Bromide	$Na\,Br+4\,Aq$	175
,, Carbonate (Cryst.)	$Na_2\,CO_3+10\,Aq$	286
,, Chloride	$Na\,Cl$	58·5
,, Hydrate	$Na\,H\,O$	40
,, Hyposulphite (Cryst.)	$Na_2\,S_2\,O_3+5\,Aq$	248
,, Iodide	$Na\,I+4\,Aq$	222
,, Sulphite	$Na_2\,SO_3+7\,Aq$	252
Strontium, Bromide	$Sr\,Br_2$	247·5
,, Chloride	$Sr\,Cl_2$	158·5
,, Iodide	$Sr\,I_2$	341·5
Tin, Chloride (Stannous)	$Sn\,Cl_2+2\,Aq$	225
,, ,, Stannic	$Sn\,Cl_4$	260
Uranium, Bromide	$U\,Br_2+4\,Aq$	352
,, Nitrate	$U_2\,O_3\,(NO_3)_2+6\,Aq$	504
Zinc, Bromide	$Zn\,Br_2$	225·2
,, Chloride	$Zn\,Cl_2$	136·2
,, Iodide	$Zn\,I_2$	319·2

TABLE OF THE SOLUBILITIES OF THE PRINCIPAL SUBSTANCES USED IN PHOTOGRAPHY.

	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling.		
Acid, Boracic (Anhydrous)	47·01	...	2·13	soluble
,, ,, (Cryst.)	25·66	3·0	3·9	sol. in 6 parts @ 60°
,, Citric	0·75	0·5	133·0	sol. in 1·15 pt. s. g. 820
,, Gallic	100·0	3·0	1·0	soluble in 4 parts
,, Oxalic	15·5	1·0	6·47	insoluble
,, Pyrogallic	2·25	...	...	sol. in alc. and ether
,, Salicylic	87·2	vry sol	0·35	easily soluble
,, Succinic	5·0	2·2	20·0	soluble in 3 parts
,, Tannic	very	solubl	e	sol. in alc. and ether
,, Tartaric	·66	·5	150·0	soluble
Alum (Potash)	10·5	vry sol	9·52	insoluble
,, (Ammonia)	7·32	,,	13·66	,,
Amidol	very	solubl	e	
Ammonium, Bromide	1·4	0·78	41·1	sol. in 32·3 parts
,, Carbonate	3·3	·833	33·0	insoluble
,, Chloride	2·7	1·00	37·02	sparingly soluble
,, Citrate	deliqu	escent	vy. sol.	less sol. in alcohol
,, Iodide	very	solubl	e	soluble
,, Nitrate	2·0	1·0	50·0	freely soluble
,, Oxalate	4·0	2·0	...	soluble
,, Salicylate	very	solubl	e	
,, Succinate	,,	,,		
,, Sulphocyanide	deliqu	escent	easily	sol. in water and alc.
Barium, Bromide	·96	...	104·2	easily soluble
,, Chloride { Crystallised	2·18	...	46·0	very slightly soluble
Anhydrous.	2·862	...	34·1	
,, Iodide	0·48	0·35	208·3	easily soluble
,, Nitrate	12·2	2·84	8·18	
Cadmium, Bromide	easily	solubl	e	easily soluble
,, Chloride	0·71	0·67	...	,,
,, Iodide	1·08	0·75	92·6	very soluble
Calcium, Bromide (Cryst.)	0·97	...	102·56	easily soluble
,, Chloride	0·25	any qy	400·0	
,, Iodide	deliqu	escent		
Cobalt, Chloride	very	solubl	e	sol. in alc. and ether
Copper, Bromide (Cupric)	deliqu	escent	vy. sol.	,, ,,
,, Chloride ,,	,,	,,	,,	,, ,,
,, Nitrate	solubl	e	....	very soluble
,, Sulphate	2·5	....	40·0	insoluble
Eikonogen	40·0	vry sol	...	soluble
Gold, Perchloride	deliqu	escent	vy. sol.	soluble in ether

TABLE OF THE SOLUBILITIES, &c.—CONTINUED.

	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling.		
Iron, Chloride (Ferrous) Anhyd.	2·0	...	50·0	sol. in 1 part alcohol
Iron, Chloride (Ferrous) Hydrated	0·68	...	147·0	easily soluble
,, Chloride (Ferric)	very	del. &	sol.	very soluble
,, Oxalate ,,	insolu	ble, ex	cept in	excess of oxalic acid
,, Sulphate ,,	solubl	e	...	soluble
,, ,, (Ferrous)	1·3	·30	77·0	insoluble
Lead, Acetate	3·7	3·45	27·0	soluble in 12·5 parts
,, Nitrate	7·7	...	13·0	
Lithium, Bromide	0·66	...	149·8	soluble
,, Chloride	1·315	...	76·0	
,, Iodide	0·61	...	164·0	
Magnesium, Bromide	deliqu	escent	vy. sol.	very soluble
,, Chloride	1·857	...	53·8	
,, Iodide	deliqu	escent	vy. sol.	soluble
,, Sulphate	1·47	0·66	68·04	slightly soluble
Mercury, Chloride (Mercuric)	16·0	3·0	6·25	soluble in 2·35 parts
Platinum, Bichloride	solubl	e	...	easily sol. in alc. & ether
Potassium, Bichromate	10·0	...	10·0	
,, Bromide	1·55	...	64·5	
,, Carbonate	0·9	...	111·0	
,, Chloride	3·03	2·0	33·0	slightly soluble
,, Citrate	very	solubl	e	
,, Cyanide	deliqu	escent	vy. sol.	insol. in pure alcohol
,, Ferrocyanide	3·0	1·0	33·3	insoluble
,, Ferridcyanide	2·54	1·22	39·37	very sparingly soluble
,, Hydrate	0·5	...	200·0	very soluble
,, Iodide	0·7	0·27	143·0	sol. in 40 pts. abs. alc.
,, Nitrate	3·5	0·4	28·57	insoluble
,, Nitrite	deliqu	& solu	ble	
,, Oxalate (neutral)	3·0	...	33·3	slightly soluble
,, ,, (bin.)	40·0	...	2·5	insoluble
,, ,, (quad.)	20·17	...	4·95	insoluble
,, Permanganate	16·0	...	6·25	insoluble
,, Sulphocyanide				
Silver, Acetate	very	slightl	y sol.	
,, Citrate	solubl	e in wa	rm wate	r
,, Fluoride	deliqu	escent		
,, Nitrate	1·0	0·5	100·0	sol. in 4 pts. boiling alc
,, Nitrite	300·0	dissol. easily	0·33	insoluble
,, Oxalate	spar'ly sol.	solubl	e	insoluble

TABLE OF THE SOLUBILITIES, &c.—Continued.

	One part is soluble in — parts of water.		100 parts of water dissolve at ordinary temperature.	Solubility in Alcohol.
	Cold.	Boiling.		
Silver, Sulphate	200·0	88·0	0·5	insoluble
Sodium, Acetate (Cryst.)	2·86	·66	35·0	
,, Biborate (Borax)	12·44	2·0	8·033	insoluble
,, Bromide	1·13	...	88·5	
,, Carbonate (Cryst.)	2·0	1·0	50·0	insoluble
,, ,, (Anhyd.)	3·85	2·07	25·93	insoluble
,, Chloride	2·77	2·77	36·0	sparingly soluble
,, Citrate	1·0	...	100·0	sparingly soluble
,, Hydrate	1·65	...	60·63	easily soluble
,, Hyposulphite (Thiosulphate)	deliqu	escent	vy. sol.	insoluble
,, Iodide	0·55	0·3	180·0	sparingly soluble
,, Nitrate	1·136	...	88·03	sol. in 37 parts alc.
,, Nitrite	deliqu	escent	vy. sol.	very soluble
,, Phosphate	4·0	2·0	25·0	
,, Succinate	very s	oluble		
,, Sulphate	2·08	0·41	48·0	soluble
,, Sulphite	4·0	...	25·0	slightly soluble
,, Bisulphite	very s	oluble	...	insoluble
,, Sulphocyanide ...				
,, Tartrate	1·75	...	56·37	insoluble
,, Tungstate	4·0	2·0	25·0	
Strontium, Bromide	1·01	...	99·0	sparingly soluble
,, Chloride	1·88	...	53·0	feebly soluble
,, Iodide	0·56	0·27	178·5	
Uranium, Bromide (Hydrated)	deliqu	& solu	ble	soluble
,, Nitrate	0·5	...	200·0	sol. in alc. and ether
,, Oxalate	nearly insol.	30·0	...	insoluble
Zinc, Bromide	deliqu	escent	vy. sol.	very soluble
,, Chloride	0·333	...	300·0	very soluble
,, Iodide	vy. de	liques.	& sol.	very soluble

Percentage of Real Ammonia in Solutions of different Densities at 14° Centigrade.—Carius.

Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.	Specific Gravity.	Percentage Ammonia.
0·8844	36·0	0·9052	27·0	0·9314	18·0	0·9631	9·0
0·8864	35·0	0·9078	26·0	0·9347	17·0	0·9670	8·0
0·8885	34·0	0·9106	25·0	0·9380	16·0	0·9709	7·0
0·8907	33·0	0·9133	24·0	0·9414	15·0	0·9749	6·0
0·8929	32·0	0·9162	23·0	0·9449	14·0	0·9790	5·0
0·8953	31·0	0·9191	22·0	0·9484	13·0	0·9831	4·0
0·8976	30·0	0·9221	21·0	0·9520	12·0	0·9873	3·0
0·9001	29·0	0·9251	20·0	0·9556	11·0	0·9915	2·0
0·9026	28·0	0·9283	19·0	0·9593	10·0	0·9959	1·0

THERMOMETRIC TABLES,
SHOWING THE ASSIMILATION OF THE THERMOMETERS IN USE THROUGHOUT THE WORLD.

Celsius.	Réaumur.	Fahrenheit.	Celsius.	Réaumur.	Fahrenheit.
100	80·0	212·0	49	39·2	120·2
99	79·2	210·0	48	38·4	118·4
98	78·4	208·4	47	37·6	116·6
97	77·6	206·6	46	36·8	114·8
96	76·8	204·8	45	36·0	113·0
95	76·0	203·0	44	35·2	111·2
94	75·2	201·2	43	34·8	109·4
93	74·4	199·4	42	33·6	107·6
92	73·6	197·6	41	32·8	105·8
91	72·8	195·8	40	32·0	104·0
90	72·0	194·0	39	31·2	102·2
89	71·2	192·2	38	30·4	100·4
88	70·4	190·4	37	29·6	98·6
87	69·6	188·6	36	28·8	96·8
86	68·8	186·8	35	28·0	95·0
85	68·0	185·0	34	27·2	93·2
84	67·2	183·2	33	26·4	91·4
83	66·4	181·4	32	25·6	89·6
82	65·6	179·6	31	24·8	87·8
81	64·8	177·8	30	24·0	86·0
80	64·0	176·0	29	23·2	84·2
79	63·2	174·2	28	22·4	82·4
78	62·4	172·4	27	21·6	80·6
77	61·6	170·6	26	20·8	78·8
76	60·8	168·8	25	20·0	77·0
75	60·0	167·0	24	19·2	75·2
74	59·2	165·2	23	18·4	73·4
73	58·4	163·4	22	17·6	71·6
72	57·6	161·6	21	16·8	69·8
71	56·8	159·8	20	16·0	68·0
70	56·0	158·0	19	15·2	66·2
69	55·2	156·2	18	14·4	64·4
68	54·4	154·4	17	13·6	62·6
67	53·6	152·6	16	12·8	60·8
66	52·8	150·8	15	12·0	59·0
65	52·0	149·0	14	11·2	57·2
64	51·2	147·2	13	10·4	55·4
63	50·4	145·4	12	9·6	53·6
62	49·6	143·6	11	8·8	51·8
61	48·8	141·8	10	8·0	50·0
60	48·0	140·0	9	7·2	48·2
59	47·2	138·2	8	6·4	46·4
58	46·4	136·4	7	5·6	44·6
57	45·6	134·6	6	4·8	42·8
56	44·8	132·8	5	4·0	41·0
55	44·0	131·0	4	3·2	39·2
54	43·2	129·2	3	2·4	37·4
53	42·4	127·4	2	1·6	36·5
52	41·6	125·6	1	0·8	33·8
51	40·8	123·8	0	0·0	32·0
50	40·0	122·0			

TABLE SHOWING THE HOURLY VARIATION IN THE SUN'S POSITION

CALCULATED BY

		A.M.						
Mean Time		5	6	7	8	9	10	11
Jan. 1						41°E.	29°E.	16°E.
Feb. 1					59°E.	47	35	19
,, 20					63	50	36	20
Mar. 8				77°E.	65	52	37	21
,, 21				80	67	53	38	22
April 2			94° E.	82	69	55	40	21
,, 19		108° E.	97	85	72	58	41	21
May 8	4 A.M.	111	100	89	76	61	44	22
,, 27	125°E.	114	103	91	79	65	47	26
June 22	127°E.	116	106	95	82	68	51	28
July 18		115	104	93	81	67	51	29
Aug. 5		114	101	91	78	62	47	27
,, 25			97	85	73	59	43	
Sept. 10			92	80	67	54	38	19
,, 23			88	77	64	50	35	17
Oct. 6				73	60	46	31	15
,, 22				69	57	44	29	12
Nov. 9					53	40	27	11
,, 22					52	39	25	11
Dec. 22						40	27	15

Calculated for latitude 52° N.

IN DEGREES FROM THE SOUTH, AT DIFFERENT SEASONS OF THE YEAR

J. A. C. Branfill.

	P.M.							
Noon	1	2	3	4	5	6	7	8
1° E.	13° W.	27° W.	40° W.					
4	12	27	40	53° W.				
4	13	29	44	57				
4	15	31	46	61	73° W.			
3	17	34	49	64	77	89° W.		
1	20	39	54	69	81	92		
1° W.	22	42	58	73	85	97	108° W.	
2	26	46	63	77	90	102	113	
1° W.	27	49	67	80	93	104	114	126° W.*
1° E.	27	49	67	81	94	105	115	127° W
2	23	46	64	79	91	102	113	125
2	22	44	61	75	88	100	111	
1	21	41	58	72	85	97	108*	
1° W.	21	39	55	69	82	94		
3	21	38	53	67	79			
4	21	37	52	65	77			
	20	36	50	63				
5	19	34	47	59				
4	19	33	45					
1° W.	15	28	41					

N.B.—Bearings marked * are taken when the sun is below the horizon.

RELATIVE EXPOSURES FOR VARYING PROPORTIONS OF IMAGE TO THE ORIGINAL.

[The following paper was read before the Royal Photographic Society by Mr. W. E. Debenham. Its usefulness would be diminished by abbreviation, hence we reproduce it in full.—Ed.]

When an enlarged photograph has to be made, either from a negative or print, it is commonly understood that the greater the degree of enlargement the longer will be the exposure required, but I have generally found only the vaguest ideas to exist as to the amount by which such exposure has to be prolonged. Sometimes, indeed, it is assumed that the exposure will be in direct inverse proportion to the area covered, so that a copy of twice the linear dimensions of the original—covering, as it does, the area of four times the size—would require an exposure of four times that sufficing for a copy of the same size. This calculation, however, omits to recognise an important factor, and leads to serious error, the actual exposure required in the case mentioned (assuming the same lens and stop to be used) being not four times, but two and a quarter times, that of a copy of same size; whilst, when we come to high degrees of enlargement, the error would amount to an indication of nearly four times the exposure actually required.

To find the relative exposure, add one to the number of times that the length of the original is contained in the length of the image, and square the sum. This will give the figure found in the third column of the annexed table.

As examples: suppose a copy is wanted having twice the linear dimensions of the original. Take the number 2, add 1 to it, and square the sum, $3^2=9$. Again, if a copy is to be of eight times the linear dimensions of the original, take the number 8, add 1, and square the sum, $9^2=81$. Copies respectively twice and eight times the size (linear) of the original will thus require relative exposures of 9 and 81—*i.e.*, the latter will require nine times the exposure of the former.

It is convenient to have a practical standard for unity. An image of the same size as the original is a familiar case, and serves as such standard. By dividing the figures in the third column by four, we get at the figures in the last column, which represent the exposure required for varying degrees of enlargement or reduction, compared with the exposure for a copy of the same size.

The table is carried up to enlargements of thirty diameters; that is about the amount required for enlarging a small *carte-de-visite* to life size.

The exposures required in reductions do not vary at all to the same extent that they do in enlargements. It has, therefore, not been thought necessary to fill in the steps between images of $\frac{1}{10}$ and $\frac{1}{20}$, and between $\frac{1}{20}$ and $\frac{1}{30}$ of the size of the original. Beyond $\frac{1}{30}$ there is scarcely any perceptible difference in the exposure until disturbance comes in from another cause, a considerable distance of illuminated atmosphere (haze or fog) intervening.

The figures in the second column will also serve as a table for distances from the lens to the plate and to the original, all that is necessary being to multiply by the principal focus of the lens in use. In the case of enlargements the figures less than 2 must be multiplied to get the distance from the original to the lens, and the figures greater than 2 for the distance from lens to image. For reductions, the figures less than 2, multiplied by the principal focus of the lens, yield the distance from lens to plate; and the figures higher than 2, similarly multiplied, give the distance of original from lens.

Proportion of image to original (linear).	Distance of image from lens * in terms of principal focus.	Proportionate exposures.	Exposures proportioned to that required for copying same size.
$\frac{1}{30}$	$1\frac{1}{30}$	1·07	·27
$\frac{1}{20}$	$1\frac{1}{20}$	1·10	·28
$\frac{1}{10}$	$1\frac{1}{10}$	1·21	·3
$\frac{1}{8}$	$1\frac{1}{8}$	1·27	·31
$\frac{1}{6}$	$1\frac{1}{6}$	1·36	·34
$\frac{1}{4}$	$1\frac{1}{4}$	1·56	·39
$\frac{1}{2}$	$1\frac{1}{2}$	2·25	·56
$\frac{3}{4}$	$1\frac{3}{4}$	3·06	·76
(Same 1	2	4	1
size) 2	3	9	2·25
3	4	16	4
4	5	25	6·25
5	6	36	9
6	7	49	12·25
7	8	64	16
8	9	81	20·25
9	10	100	25
10	11	121	30·25
11	12	144	36
12	13	169	42·25
13	14	196	49
14	15	225	56·25
15	16	256	64
16	17	289	72·25
17	18	324	81
18	19	361	90·25
19	20	400	100
20	21	441	110·25
21	22	484	121
22	23	529	132·25
23	24	576	144
24	25	625	156·25
25	26	676	169
26	27	729	182·25
27	28	784	196
28	29	841	210·25
29	30	900	225
30	31	961	240·25

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* With a double lens it is usually sufficient to measure from the position of the diaphragm plate.

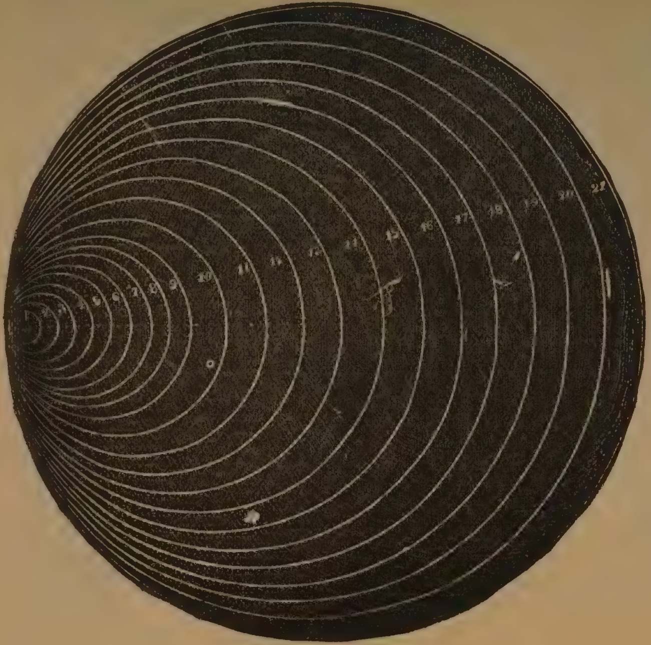
‘UNIFORM SYSTEM’ NUMBERS FOR STOPS FROM $\frac{f}{1}$ TO $\frac{f}{100}$.

In the following table Mr. S. A. Warburton has calculated the exposure necessary with every stop from $\frac{f}{1}$ to $\frac{f}{100}$ compared with the unit stop of the ‘uniform system’ of the Royal Photographic Society of Great Britain. The figures which are underlined show in the first column what $\frac{f}{a}$ must be in order to increase the exposure in geometrical ratio from $\frac{f}{4}$, the intermediate numbers showing the uniform system number for any other aperture.

	U. S. No.	f	U. S. No.	f	U. S. No.
1	1/16	15	14·06	58	210·25
1¼	·097	16	16	59	217·56
1·414	⅛	17	18·06	60	225·00
1½	·140	18	20·25	61	232·56
1¾	·191	19	22·56		240·25
2	¼	20	25·00	63	248·06
2¼	·316	21	27·56	64	256
2½	·390	22	30·25	65	264·06
2·828	½	22·62	32	66	272·25
2¾	·472	23	33·06	67	280·56
3	·562	24	36·00	68	289·00
3¼	·660	25	39·06	69	297·56
3½	·765	26	42·25	70	306·25
3¾	·878	27	45·56	71	315·06
4	1·00	28	49·00	72	324·00
4¼	1·12	29	52·56	73	333·06
4½	1·26	30	56·25	74	342·25
4¾	1·41	31	60·06	75	351·56
5	1·56	32	64	76	361·00
5¼	1·72	33	68·06	77	370·56
5½	1·89	34	72·25	78	380·25
5·656	2	35	76·56	79	390·06
5¾	2·06	36	81·00	80	400·00
6	2·25	37	85·56	81	410·06
6¼	2·44	38	90·25	82	420·25
6½	2·64	39	95·06	83	430·56
6¾	2·84	40	100·00	84	440·00
7	3·06	41	105·06	85	451·56
7¼	3·28	42	110·25	86	462·25
7½	3·51	43	115·56	87	473·06
7¾	3·75	44	121·00	88	484·00
8	4	45	126·56	89	495·06
8¼	4·25	45·25	128	90	506·25
8½	4·51	46	132·25	90·50	512
8¾	4·78	47	138·06	91	517·56
9	5·06	48	144·00	92	529·00
9¼	5·34	49	150·06	93	540·56
9½	5·64	50	156·25	94	552·25
9¾	5·94	51	162·56	95	564·06
10	6·25	52	169·00	96	576·00
11	7·56	53	175·56	97	588·06
11·31	8	54	182·25	98	600·25
12	9·00	55	189·06	99	612·56
13	10·56	56	196·00	100	625·00
14	12·25	57	203·06		

THE ROYAL PHOTOGRAPHIC SOCIETY'S STANDARD DIAPHRAGMS.

The annexed diagram and table are intended to facilitate the calculation of the proper number with which to mark the diaphragms according to the Royal Photographic Society of Great Britain's Uniform System, which will be found described on another page. This number is called the 'U. S.' (or uniform system number). The numbered circles in the diagram represent the sizes of stops. The photographer, knowing the equivalent focus of his lens, looks along the line opposite the number which represents the circle nearest inside to his diaphragm, and when he gets to the column headed by that equivalent focus the number there found is the U. S. number to be marked on the diaphragm. For example: a lens of eight inches equivalent focus has a diaphragm in size about No. 5 on the diaphragm; running the eye along the line opposite No. 5, we find in the column under—'focus eight inches' the number 11, which is the U. S. number required.



No. of Circle.	4 focus	5 focus	6 focus	7 focus	8 focus	9 focus	10 focus	12 focus	14 focus
1	25	39	56						
2	11	17	25	34	44	56	68		
3	6¼	10	14	19	25	31	40	56	
4	4	6¼	9	12	16	20	25	36	48
5	2¾	4¼	6¼	8½	11	14	17	25	34
6	2	3⅕	4½	6¼	8	10	13	18	25
7	1½	2½	3½	4¾	6	8	10	14	19
8	1¼	2	2¾	3¾	5	6¼	8	11	15
9	1	1½	2¼	3	4	5	6¼	9	12¼
10		1	1½	2⅛	2¾	3½	4⅓	6	8½
11			1¼	1½	2	2½	3⅕	5	6
12			⅞	1⅕	1½	2	2½	3½	4¾
13				1	1¼	1⅚	1⅔	2¾	4
14					1	1¼	1½	2¼	3
15						1	1⅓	1⅞	2½
16							1	1½	2
17								1⅓	7⅔
18								1⅙	1½
19								1	1⅓
20									1⅕
21									1

TABLE FOR FINDING THE MINIMUM LENGTH OF STUDIO FOR A GIVEN LENS.

(*From the 'American Amateur Photographer.'*)

DISTANCES IN INCHES FROM OBJECT TO LENS.

Equivalent Focus of Lens. In.	3 in. high.	4 in. high.	5 in. high.	6 in. high.	8 in. high.	10 in. high.	12 in. high.	16 in. high.	20 in. high.	24 in. high.	30 in. high.	36 in. high.	48 in. high.	54 in. high.	60 in. high.	72 in. high.
3	75	57														
4	100	76	61⅗	52												
5	125	95	77	65	50											
6	150	114	92⅗	78	60	49⅛										
8	200	152	123⅕	104	80	65 6/10	56									
10	250	190	154	130	100	82	70	55								
12	300	228	184⅘	156	120	98⅗	84	66	55⅕							
16	400	304	246⅖	208	161	131⅕	112	88	72⅖	64	54⅘	48				
20	500	380	308	260	200	164	140	110	90¾	80	68	60	50	46⅔		
24	600	456	369⅗	312	240	196⅘	168	132	110⅖	96	81⅗	72	60	56	52⅘	48
30	750	540	462	390	300	246	210	165	136⅛	120	102	90	75	70	65	60
36	900	684	554⅖	463	360	307⅕	252	198	165⅗	144	122⅖	108	90	84	79⅛	72
48	1200	912	739⅕	624	480	393⅕	336	264	220⅘	192	163⅕	144	120	112	105⅜	96
60	1500	1080	1024	780	600	492	420	330	272¼	240	204	180	150	140	132	120
72	1800	1368	1108⅘	936	720	614⅖	504	396	321⅕	288	244⅘	216	180	168	158⅜	144

DISTANCES IN INCHES FROM LENS TO GROUND GLASS.

Equivalent Focus of Lens. In.	3 in. high.	4 in. high.	5 in. high.	6 in. high.	8 in. high.	10 in. high.	12 in. high.	16 in. high.	20 in. high.	24 in. high.	30 in. high.	36 in. high.	48 in. high.	54 in. high.	60 in. high.	72 in. high.
3	3⅛	3⅙														
4	4⅙	4 2/9	4 5/18	4⅓												
5	5 5/24	5 5/18	5 25/72	5 5/12	5 5/9											
6	6⅙	6⅓	6 5/12	6½	6⅔	7 1/9										
8	8⅓	8 4/9	8 5/9	8⅔	8 8/9	9 1/9	9⅓									
10	10 5/12	10 5/9	10 25/36	10⅚	11 1/9	11 7/18	11½	12 2/9								
12	12½	12⅔	12⅚	13	13⅓	13⅔	14	14⅔	15⅓							
16	16⅔	16 8/9	17 1/9	17⅓	17 7/9	18 2/9	18⅔	19 5/9	20⅙	21⅓	22⅔	24				
20	20⅚	21 1/9	21 7/18	21⅔	22 3/9	22 7/9	23⅓	24 4/9	25 5/24	26⅔	28⅓	30	33⅓	35		
24	25	25⅓	25⅔	26	26⅔	26⅝	28	29⅓	30⅔	32	34	36	40	42	44	48
30	31¼	31⅔	32 1/12	32½	33 3/9	34⅙	35	36⅔	38⅛	40	42½	45	50	52½	55	60
36	37½	38	38½	39	39⅔	40	42	44	46	48	51	54	60	63	66	72
48	50	50⅔	51⅓	52	53⅓	54⅔	56	58⅔	61⅓	64	68	72	80	84	88	96
60	62½	63⅓	64⅙	65	66⅔	68⅓	70	73⅓	77⅔	80	85	90	100	105	110	120
72	75	76	77	78	79⅛	80	84	88	92	96	102	108	120	126	132	144

Suppose the lens used is 24 in. equivalent focus, and you wish to make a full-length portrait of a man 6 ft. high, in which the image will be 6 in. high. Look at the left-hand column for lens focus, and in the top line for size of image. At the intersection of these columns we find 312 in.=26 ft., to be the distance the person must stand from the lens. In the next table, using the same lens and size of image as before, at the intersection of the columns we find 26 in., which represents the distance of the ground glass from lens centre, And in the same way any lens and size of image may be computed for.

CONTINENTAL STOPS AND THEIR U.S. EQUIVALENTS.

Mr. Edward M. Nelson says: 'Photographers are frequently troubled by the Continental nomenclature of the stops, and wish to know the U.S. equivalents for them. The method of finding this out is very simple. All that is necessary is to divide f-4 by the ratio to be converted, and square the result. Example: Required the U.S. equivalent of f-9:—

$$\frac{f}{4} \div \frac{f}{9} = \frac{f}{4} \times \frac{9}{f} = 2{\cdot}25;$$

the square of 2·25 is 5·06, the U.S. number required. The following is table of the Continental stops more commonly met with, and also the Continental values of the U.S. ratios:—

Ratios. f divided by	Continental Values.	U.S. Values.	Ratios. f divided by	U.S. Values.	Continental Values.
4·5	512	1·26	2·828	·5	1250
6·3	256	2·48	4	1	625
7	204	3·06	5·66	2	312
7·2	193	3·24	8	4	156
7·7	168	3·71	11·31	8	78
9	128	5·06	16	16	39
12·5	64	9·77	22·6	32	20
14·5	47	13	32	64	9·77
18	32	20	45·3	128	4·88
25	16	39	64	256	2·44
36	8	81	90·5	512	1·22
50	4	156	...	...	...
71	2	315	...	...	...
100	1	625	...	...	...

'To find the f ratio for the U.S. values, multiply the U.S. value by 16, and the square root of the product is the required ratio. Example: What is the ratio of U.S. 32? 32 multiplied by 16 is 512, the square root of this is 22·6, the ratio required.

'To find the f ratio for the Continental stops, multiply the reciprocal of the square root of the Continental value by 100. Example: What is the f ratio of the Continental value 16? The square root of 16 is 4, the reciprocal of 4 is ·25, which, multiplied by 100, is 25, the ratio required.

'*Note.*—The Continental ratios of 512, 256, and 8, ought to be 4·4, 6·25, and 35, respectively. The figures in the list are those extracted from Continental opticians' catalogues.'

TABLE SHOWING DISPLACEMENT ON GROUND GLASS OF OBJECTS IN MOTION.

By Henry L. Tolman.

From the 'Photographic Times.'

Lens 6 Inches Equivalent Focus, Ground Glass at Principal Focus of Lens.

Miles per hour.	Feet per second.	Distance on Ground Glass, in Inches, with Object 30 Feet away.	Same with Object 60 Feet away.	Same with Object 120 Feet away.
1	1½	·29	·15	·073
2	3	·59	·29	·147
3	4½	·88	·44	·220
4	6	1·17	·59	·293
5	7½	1·47	·73	·367
6	9	1·76	·88	·440
7	10½	2·05	1·03	·513
8	12	2·35	1·17	·587
9	13	2·64	1·32	·660
10	14½	2·93	1·47	·733
11	16	3·23	1·61	·807
12	17½	3·52	1·76	·880
13	19	3·81	1·91	·953
14	20½	4·11	2·05	1·027
15	22	4·40	2·20	1·100
20	29	5·87	2·93	1·467
25	37	7·33	3·67	1·833
30	44	8·80	4·40	2·200
35	51	10·27	5·13	2·567
40	59	11·73	5·97	2·933
45	66	13·20	6·60	3·300
50	73	14·67	7·33	3 667
55	80	16·13	8·06	4·033
60	88	17·60	8·80	4·400
75	110	22·00	11·00	5·500
100	147	29·33	14·67	7·333
125	183	36·67	18·33	9·167
150	220	44·00	22·00	11·000

THE ROYAL PHOTOGRAPHIC SOCIETY'S STANDARDS.

[The following is reprinted from the Society's *Journal.*]

The Standards adopted by the Society in 1881 have been carefully reconsidered to see what additions or modifications were desirable.

The following statement is complete so far as the subjects it deals with are concerned:—

Lens Diaphragms.

It is recommended:—

1st. That the aperture of the standard-unit diaphragm have a diameter equal to one-fourth the equivalent focal length of the lens.

2nd. That diaphragms with smaller openings have apertures diminishing in area to the extent of one-half from the unit standard downwards.

3rd. That every diaphragm be marked with its intensity ratio, and also with the relation that the diameter of its aperture bears to the equivalent focal length of the lens, thus:—

$$\frac{f}{4};\ 2\,\frac{f}{5{\cdot}6};\ 4\,\frac{f}{8};\ 8\,\frac{f}{11{\cdot}3};\ 16\,\frac{f}{16};\ 32\,\frac{f}{22{\cdot}6};\ 64\,\frac{f}{32};\ 128\,\frac{f}{45{\cdot}2};\ 256\,\frac{f}{64};\ \&c.$$

Should a lens not admit of a diaphragm with an aperture as large in diameter as one-fourth its focal length, nor exactly any one of the above-mentioned sizes, it is still recommended that all the apertures be made in uniformity with the above scale, with the exception of the largest, which should be marked with the number its area requires in relation to the unit diaphragm. In the case of a lens having a working aperture exceeding in diameter one-fourth its focal length, the diaphragms should be marked according to the sizes of their relative apertures: for example:—

$$0{\cdot}5\,\frac{f}{2{\cdot}8};\ 0{\cdot}25\,\frac{f}{2},\ \&c.$$

And diaphragms which require to be made with apertures intermediate to the standard sizes should be marked in a corresponding manner.

Lens Mounts and Fittings.

It is recommended:—

1st. That the equivalent focal length of each lens be engraved upon its mount.

2nd. That the following series of screws for photographic lens flange fittings be adopted:—

Diameter in Inches.	No. of Threads per Inch.	Core Diameter in Inches.
1	24	·9466
1·25	24	1·1966
1·5	24	1·4466
1·75	24	1·6966
2	24	1·9466
2·25	24	2·1966
2·5	24	2·4466
3	24	2·9466
3·5	12	3·3933
4	12	3·8933
5	12	4·8933
And upwards, advancing by inches.	12	

The form of thread is that known as Whitworth's Angular Thread, and is designed as follows:—Two parallel lines, at a distance apart equal to 0·96 of the screw pitch, are intersected by lines inclined to each other at 55°. One-sixth of the vertical height of the triangular spaces so obtained is rounded off both at the top and bottom. The depth of this thread is 0·64 of the screw pitch.

3rd. That every flange and adapter have a mark upon its front to indicate the position of the diaphragm slot or index of any lens when screwed home. The mark on any adapter should coincide with the mark upon any flange into which it is screwed. This mark should be placed at the point at which the thread becomes complete at the shoulder of the flange or adapter.

CAMERA SCREWS.

It is recommended:—

That all screws fitted to cameras, either for attachment to the stand, for fixing rising fronts, or for other movable parts, be either $\frac{3}{16}$, $\frac{1}{4}$, $\frac{5}{16}$, or $\frac{3}{8}$ of an inch in external diameter, and in pitch of thread and other details in accordance with the generally recognised Whitworth standards for these sizes.

Focus of Lens, inches.	TIMES OF ENLARGEMENT AND REDUCTION.							
	1 inches.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.
2	4 4	6 3	8 $2\frac{2}{3}$	10 $2\frac{1}{2}$	12 $2\frac{2}{5}$	14 $2\frac{1}{3}$	16 $2\frac{2}{7}$	18 $2\frac{1}{4}$
$2\frac{1}{2}$	5 5	$7\frac{1}{2}$ $3\frac{3}{4}$	10 $3\frac{1}{3}$	$12\frac{1}{2}$ $3\frac{1}{8}$	15 3	$17\frac{1}{2}$ $2\frac{11}{12}$	20 $2\frac{6}{7}$	$22\frac{1}{2}$ $2\frac{13}{16}$
3	6 6	9 $4\frac{1}{2}$	12 4	15 $3\frac{3}{4}$	18 $3\frac{3}{5}$	21 $3\frac{1}{2}$	24 $3\frac{3}{7}$	27 $3\frac{3}{8}$
$3\frac{1}{2}$	7 7	$10\frac{1}{2}$ $5\frac{1}{4}$	14 $4\frac{2}{3}$	$17\frac{1}{2}$ $4\frac{3}{8}$	21 $4\frac{1}{5}$	$24\frac{1}{2}$ $4\frac{1}{12}$	28 4	$31\frac{1}{2}$ $3\frac{15}{16}$
4	8 8	12 6	16 $5\frac{1}{3}$	20 5	24 $4\frac{4}{5}$	28 $4\frac{2}{3}$	32 $4\frac{4}{7}$	36 $4\frac{1}{2}$
$4\frac{1}{2}$	9 9	$13\frac{1}{2}$ $6\frac{3}{4}$	18 6	$22\frac{1}{2}$ $5\frac{5}{8}$	27 $5\frac{2}{5}$	$31\frac{1}{2}$ $5\frac{1}{4}$	36 $5\frac{1}{7}$	$40\frac{1}{2}$ $5\frac{1}{16}$
5	10 10	15 $7\frac{1}{2}$	20 $6\frac{2}{3}$	25 $6\frac{1}{4}$	30 6	35 $5\frac{5}{6}$	40 $5\frac{5}{7}$	45 $5\frac{5}{8}$
$5\frac{1}{2}$	11 11	$16\frac{1}{2}$ $8\frac{1}{4}$	22 $7\frac{1}{3}$	$27\frac{1}{2}$ $6\frac{7}{8}$	33 $6\frac{3}{5}$	$38\frac{1}{2}$ $6\frac{5}{12}$	44 $6\frac{2}{7}$	$49\frac{1}{2}$ $6\frac{3}{16}$
6	12 12	18 9	24 8	30 $7\frac{1}{2}$	36 $7\frac{1}{5}$	42 7	48 $6\frac{6}{7}$	54 $6\frac{3}{4}$
7	14 14	21 $10\frac{1}{2}$	28 $9\frac{1}{3}$	35 $8\frac{3}{4}$	42 $8\frac{2}{5}$	49 $8\frac{1}{6}$	56 8	63 $7\frac{7}{8}$
8	16 16	24 12	32 $10\frac{2}{3}$	40 10	48 $9\frac{3}{5}$	56 $9\frac{1}{3}$	64 $9\frac{1}{7}$	72 9
9	18 18	27 $13\frac{1}{2}$	36 12	45 $11\frac{1}{4}$	54 $10\frac{4}{5}$	63 $10\frac{1}{2}$	72 $10\frac{2}{7}$	81 $10\frac{1}{8}$

The object of this table is to enable any manipulator who is about to enlarge (or reduce) a copy any given number of times, to do so without troublesome calculation. It is assumed that the photographer knows exactly what the focus of his lens is, and that he is able to measure accurately from its optical centre. The use of the table will be seen from the following illustration:—A photographer has a *carte* to enlarge to four times its size, and the lens he intends employing is one of six inches equivalent focus. He must, therefore, look for 4 on the upper horizontal line, and for 6 in the first vertical column, and carry his eye to where these two join, which will be at 30—7½. The greater of these is the distance the sensitive plate must be from the centre of the lens; and the lesser, the distance of the picture to be copied. To *reduce* a picture any given number of times the same method must be followed, but in this case the greater number will represent the distance between the lens and the picture to be copied; the latter, that between the lens and the sensitive plate. This explanation will be sufficient for every case of enlargement or reduction.

If the focus of the lens be twelve inches, as this number is not in the column of focal lengths, look out for six in this column and multiply by 2, and so on with any other numbers.

TABLE OF VIEW-ANGLES.

By Clarence E. Woodman, Ph.D.

Divide the Base of the Plate by the Equivalent Focus of the Lens.

If the quotient is	The angle is	If the quotient is	The angle is	If the quotient is	The angle is
	Degrees.		Degrees.		Degrees.
·282	16	·748	41	1·3	66
·3	17	·768	42	1·32	67
·317	18	·788	43	1·36	68
·335	19	·808	44	1·375	69
·353	20	·828	45	1·4	70
·37	21	·849	46	1·427	71
·389	22	·87	47	1·45	72
·407	23	·89	48	1·48	73
·425	24	·911	49	1·5	74
·443	25	·933	50	1·53	75
·462	26	·954	51	1·56	76
·48	27	·975	52	1·59	77
·5	28	1·	53	1·62	78
·517	29	1·02	54	1·649	79
·536	30	1·041	55	1·678	80
·555	31	1·063	56	1·7	81
·573	32	1·086	57	1·739	82
·592	33	1·108	58	1·769	83
·611	34	1·132	59	1·8	84
·631	35	1·155	60	1·833	85
·65	36	1·178	61	1·865	86
·67	37	1·2	62	1·898	87
·689	38	1·225	63	1·931	88
·708	39	1·25	64	1·965	89
·728	40	1·274	65	2·	90

Example.—Given a lens of 13 inches equivalent focus; required the angle included by it on plates respectively 3¼ × 4¼, 4¼ × 6½, 6½ × 8½, 8 × 10, 10 × 12, and 11 × 14.

1. Dividing 4·25 by 13, we have as quotient ·327—midway between the decimals ·317 and ·335 of our table; therefore the required angle is 18° 30′. Similarly—

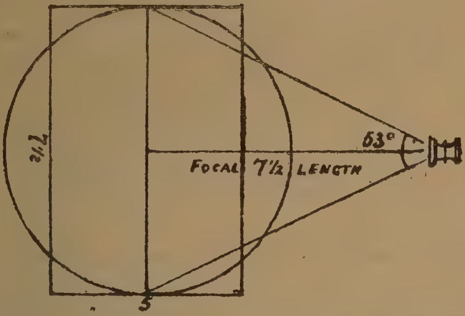
Degrees.
2. 6·5 ÷ 13 = ·5; corresponding to 28.
3. 8·5 ÷ 13 = ·654; „ „ 36.
4. 10 ÷ 13 = ·77; „ „ 42½.
5. 12 ÷ 13 = ·923 „ „ 49½.
6. 14 ÷ 13 = 1·08 „ „ 57.

VIEW-ANGLES.

The late Mr. M. J. Michael wrote us as follows :—

'I take this opportunity of drawing your attention to the "Table of View-angles," in The British Journal Photographic Almanac. If used as there directed, it leads to results inaccurate and misleading; inaccurate, since the angle included on a plate should be measured along the diagonal and not along the base of the plate; and the information is misleading, since it leads to the supposition that a lens having the angle which is given by using the table, as there directed, will cover the plate mentioned. Hence all the examples given at the foot of the table specify lenses that, if used on the given plates, must leave at least two, and if the lens is placed centrally, all the four, corners uncovered. If the corners of a plate are to be covered, the angle embraced by the lens must be sufficient to cover the diagonal of the plate; in other words, the circle of illumination given by the lens must have a diameter equal to the diagonal of the plate, and not only equal to the length of the base of the plate.

'A simple figure makes this evident. If the focal length of the lens, *e.g.*, seven and a half inches on a 7½ × 5 plate, is equal to the base of the plate, then, using the table as is directed, the quotient obtained is 1 and the angle 53°. From the figure, which is to scale, it is evident that, arrange the plate as you will, at least two, and if placed centrally, all four, corners must be uncovered, *i.e.*, outside the circle of illumination.



'The table itself is correct when used as is usually directed by dividing the diagonal of any given plate by the focal length of the lens (see Dr, Eder, *Recepte und Tabellen*, fourth edition, page 94). If, therefore, the directions for using it were altered by substituting "diagonal of the plate" for the words "base of the plate," the results obtained would be correct. It would save trouble if beneath the table were printed the length of the diagonals of the plates most commonly used :—

3¼ × 3¼	diagonal	4·6	inches.	6½ × 8½	diagonal	10·7	inches.
3¼ × 4¼	,,	5·3	,,	8 × 10	,,	12·4	,,
4 × 5	,,	6·4	,,	10 × 12	,,	15·6	,,
4¾ × 6½	,,	8·	,,	12 × 15	,,	19·4	,,
5 × 7½	,,	9·	,,				

EQUATIONS RELATING TO FOCI, &c.

THE following simple optical formulæ and calculations, worked out by Mr. J. A. C. Branfill, will prove useful in many branches of photography, especially where several lenses of varying foci are in constant use for a variety of purposes:—

Let p = Principal focus.
F = Greater conjugate do.
f = Lesser do. do.
$D = F + f$ = distance of image from object.
r = Ratio of any dimension in original to the same dimension in copy (in case of reduction), or *vice versâ* (in case of enlargement).
a = Effective diameter of diaphragm.
U. S. No. = 'Uniform System' No. of do.
x = Comparative exposure required.

Then

$$p = D \times \frac{r}{(r+1)^2} = \frac{Ff}{D} = \frac{F}{r+1} = \frac{rf}{r+1}$$

$$F = p\,(r+1) = \frac{pf}{f-p} = rf = \frac{rD}{r+1}$$

$$f = p \times \frac{(r+1)}{r} = \frac{pF}{F-p} = \frac{D}{r+1} = \frac{F}{r}$$

$$D = p \times \frac{(r+1)^2}{r} = f\,(r+1) = p\left(2 + r + \frac{1}{r}\right)$$

$$r = \frac{F-p}{p} = \frac{p}{f-p} = \frac{F}{f}$$

$$\text{U. S. No.} = \frac{p^2}{16\,a^2}$$

$$x = \frac{f^2}{16\,a^2} = \frac{p^2}{16\,a^2} \times \frac{(r+1)^2}{r^2}$$

N.B.—For ordinary landscape work, where r is greater than 20, x may be taken as $\frac{p^2}{16\,a^2}$

NOTE.—In case the above may not be clear to some photographers, the following rules may be better understood:—

To find the principal focus of a lens (p), focus a near object in the camera, and measure the distance between it and the ground-glass (D); next find the proportion which any dimension in the object bears to the same dimension on the ground-glass (r). Thus, if the original dimension be four times as large as its reproduction, we say that r equals (=) 4. Multiply D by r, and divide the product by the square of a number greater by one than r, or $(r+1)^2$. This rule was lately published by Mr. Debenham.

To find the lesser conjugate focus (f) (if p and r are known) multiply p by the sum of $r \pm 1$ and divide the product by r. Or divide D by $r \pm 1$.

To find the greater conjugate focus (F) multiply p by $r \pm 1$. Or multiply f by r.

To find D (the distance which the ground-glass should be from the object to be copied in order to get a given value for r) multiply p by the sum of $r \pm \frac{1}{r} \pm 2$.

To find r divide $F - p$ (the difference between F and p) by p. Or divide p by $f - p$. Or divide F by f.

To find x divide the square of f by 16 times the square of a (the diameter of aperture to lens).

For example: focus an object which is five inches high, so that it is one inch high on the ground glass; thus we know that $r = 5$. Next measure the distance between the object and the ground glass (D), which is found to be 45 inches.

Then $p = 45 \times$ (multiplied by) $5 \div$ (divided by) $6 \times 6 = 6\frac{1}{4}$ inches.
$f = 6\frac{1}{4} \times 6 \div 5 = 7\frac{1}{2}$ inches. Or $f = 45 \div 6 = 7\frac{1}{2}$ inches.
$F = 6\frac{1}{4} \times 6 = 37\frac{1}{2}$ inches. Or $F = 7\frac{1}{2} \times 5 = 37\frac{1}{2}$ inches.
$D = 6\frac{1}{4} \times (5 + \frac{1}{5} + 2) = 6\frac{1}{4} \times 7\frac{1}{5} = 45$ inches.
$r = (37\frac{1}{2} - 6\frac{1}{4}) \div 6\frac{1}{4} = 5$. Or $r = 6\frac{1}{4} \div (7\frac{1}{2} - 6\frac{1}{4}) = 5$.

MR. E. M. NELSON'S TABLE OF DISTANCES FOR LANTERN PROJECTION.

Distance of Projection Lens from Screen, Mask being Three Inches.

Foci	4½	5	5½	6	7	8	9	10	11	12	14	15	16	1
Disc.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.	ft.	ft. in.	ft. in.	ft. in.	ft. in.
5	7 10½	8 9	9 7½	10 6	12 3	14 0	15 9	17 6	19 3	21	24 6	26 3	28 0	31 6
6	9 4½	10 5	11 5½	12 6	14 7	16 8	18 9	20 10	22 11	25	29 2	31 3	33 4	37 6
7	10 10½	12 1	13 3½	14 6	16 11	19 4	21 9	24 2	26 7	29	33 10	36 3	38 8	43 6
8	12 4½	13 9	15 1½	16 6	19 3	22 0	24 9	27 6	30 3	33	38 6	41 3	44 0	49 6
9	13 10½	15 5	16 11½	18 6	21 7	24 8	27 9	30 10	33 11	37	43 2	46 3	49 4	55 6
10	15 4½	17 1	18 9½	20 6	23 11	27 4	30 9	34 2	37 7	41	47 10	51 3	54 8	61 6
11	16 10½	18 9	20 7½	22 6	26 3	30 0	33 9	37 6	41 3	45	52 6	56 3	60 0	67 6
12	18 4½	20 5	22 5½	24 6	28 7	32 8	36 9	40 10	44 11	49	57 2	61 3	65 4	73 6
13	19 10½	22 1	24 3½	26 6	30 11	35 4	39 9	44 2	48 7	53	61 10	66 3	70 8	79 6
14	21 4½	23 9	26 1½	28 6	33 3	38 0	42 9	47 6	52 3	57	66 6	71 3	76 0	85 6
15	22 10½	25 5	27 11½	30 6	35 7	40 8	45 9	50 10	55 11	61	71 2	76 3	81 4	91 6
16	24 4½	27 1	29 9½	32 6	37 11	43 4	48 9	54 2	59 7	65	75 10	81 3	86 8	97 6
18	27 4½	30 5	33 5½	36 6	42 7	48 8	54 9	60 10	66 11	73	85 2	91 3	97 4	109 6
20	30 4½	33 9	37 1½	40 6	47 3	54 0	60 9	67 6	74 3	81	94 6	101 3	108 0	121 6
25	37 10½	42 1	46 3½	50 6	58 11	67 4	75 9	84 2	92 7	101	117 10	126 3	134 8	151 6
30	45 4½	50 5	55 5½	60 6	70 7	80 8	90 9	100 10	110 11	121	141 2	151 3	161 4	181 6
35	52 10½	58 9	64 7½	70 6	82 3	94 0	105 0	117 6	129 3	141	164 6	176 3	188 0	211 6
40	60 4½	67 1	73 9½	80 6	93 11	107 4	120 9	134 2	147 7	161	187 10	201 3	214 8	241 6
45	67 10½	75 5	82 11½	90 6	105 7	120 8	135 9	150 10	165 11	181	211 2	226 3	241 4	271 6
50	75 4½	83 9	92 1½	100 6	117 3	134 0	150 9	167 6	184 3	201	234 6	251 3	268 0	301 6

TABLE OF DISTANCES FOR AN OBJECT OF SIXTY-EIGHT INCHES HEIGHT.

Computed by P. Brosig.

Equivalent Focus (inches).	Heights of Images (inches).																	
	1	2	3	4	6	8	10	12	14	16	20	24	28	32	40	48	56	68
2	138·0 2·0	70·0 2·1	47.3 2·1	36·0 2·1														
3	207·0 3·0	105·0 3·1	71·0 3·1	54·0 3·2	37·0 3·3													
4	276·0 4·1	140·0 4·1	94·7 4·2	72·0 4·2	49·3 4·4	38·0 4·5												
5	345·0 5·1	175·0 5·1	118·3 5·2	90·0 5·3	61·7 5·4	47·5 5·6	39·0 5·7											
6	414·0 6·1	210·0 6·2	142·0 6·3	108·0 6·4	74·0 6·5	57·0 6·7	46·8 6·9	40·0 7·1	35·1 7·2									
7	483·0 7·1	245·0 7·2	165·7 7·3	126·0 7·4	86·3 7·6	66·5 7·8	54·6 8·0	46·7 8·2	41·0 8·4	36·7 8·6								
8	552·0 8·1	280·0 8·2	189·3 8·4	144·0 8·5	98·7 8·7	76·0 8·9	62·4 9·2	53·3 9·4	46·9 9·6	42·0 9·9	35·2 10·4							
9	621·0 9·1	315·0 9·3	213·0 9·4	162·0 9·5	111·0 9·8	85·5 10·1	70·2 10·3	60·0 10·6	52·7 10·9	47·2 11·1	39·6 11·6							
10	690·0 10·1	350·0 10·3	236·7 10·4	180·0 10·6	123·3 10·9	95·0 11·2	78·0 11·5	66·7 11·8	58·6 12·1	52·5 12·4	44·0 12·9	38·3 13·5	34·3 14·1					
11	759·0 11·2	385·0 11·3	260·3 11·5	198·0 11·6	135·7 12·0	104·5 12·3	85·8 12·6	73·3 12·9	64·4 13·3	57·7 13·6	48·4 14·2	42·2 14·9	37·7 15·5	34·4 16·2				
12	828·0 12·2	420·0 12·4	284·0 12·5	216·0 12·7	148·0 13·1	114·0 13·4	93·6 13·8	80·0 14·1	70·3 14·5	63·0 14·8	52·8 15·5	46·0 16·2	41·1 16·9	37·5 17·6				
13	897·0 13·2	455·0 13·4	307·7 13·6	234·0 13·8	160·3 14·1	123·5 14·5	101·4 14·9	86·7 15·3	76·1 15·7	68·2 16·1	57·2 16·8	49·8 17·6	44·6 18·4	40·6 19·1	35·1 20·6			

Values are omitted in this space on account of the wide angle of lens required. (More than ninety degrees.)

14	966·0 14·2	490·0 14·4	331·3 14·6	252·0 14·8	172·7 15·2	133·0 15·6	109·2 16·1	93·3 16·5	82·0 16·9	73·5 17·3	61·6 18·0	53·7 18·9	48·0 19·8	43·7 20·6	37·8 22·2			
16	1104 16·2	560·0 16·5	378·7 16·7	288·0 16·9	197·3 17·4	152·0 17·9	124·8 18·4	106·7 18·8	93·7 19·3	84·0 19·8	70·4 20·7	61·3 21·6	54·9 22·6	50·0 23·5	43·2 25·4	38·7 27·3	35·4 29·2	
18	1242 18·3	630·0 18·5	426·0 18·8	324·0 19·1	222·0 19·6	171·0 20·1	140·4 20·6	120·0 21·2	105·4 21·7	94·5 22·2	79·2 23·3	69·0 24·4	61·7 25·4	56·2 26·5	48·6 28·6	43·5 30·7	39·9 32·8	36·0 36·0
20	1380 20·3	700·0 20·6	473·3 20·9	360·0 21·2	246·7 21·8	190·0 22·4	156·0 22·9	133·3 23·5	117·1 24·1	105·0 24·7	88·0 25·9	76·7 27·1	68·6 28·2	62·5 29·4	54·0 31·8	48·3 34·1	44·3 36·5	40·0 40·0
22	1518 22·3	770·0 22·6	520·7 23·0	396·0 23·3	271·3 23·9	209·0 24·6	171·6 25·2	146·7 25·9	128·9 26·5	115·5 27·2	96·8 28·5	84·3 29·8	75·4 31·1	68·7 32·4	59·4 34·9	53·2 37·5	48·7 40·1	44·0 44·0
24	1656 24·4	840·0 24·7	568·0 25·1	432·0 25·4	296·0 26·1	228·0 26·8	187·2 27·5	160·0 28·2	140·6 28·9	126·0 29·6	105·6 31·1	92·0 32·5	82·3 33·9	75·0 35·3	64·8 38·1	58·0 40·9	53·1 43·8	48·0 48·0
26	1794 26·4	910·0 26·8	615·3 27·1	468·0 27·5	320·6 28·3	247·0 29·0	202·8 29·8	173·3 30·6	152·3 31·3	136·5 32·1	114·4 33·6	99·7 35·2	89·1 36·7	81·2 38·2	70·2 41·3	62·8 44·4	57·6 47·4	52·0 52·0
28	1932 28·4	980·0 28·8	662·7 29·2	504·0 29·6	345·3 30·5	266·0 31·3	218·4 32·1	186·7 32·9	164·0 33·8	147·0 34·6	123·2 36·2	107·3 37·9	96·0 39·5	87·5 41·2	75·6 44·5	67·7 47·8	62·0 51·1	56·0 56·0
32	2208 32·5	1120 32·9	757·3 33·4	576·0 33·9	394·7 34·8	304·0 35·8	249·6 36·7	213·3 37·6	187·4 38·6	168·0 39·5	140·8 41·4	122·7 43·3	109·7 45·2	100·0 47·1	86·4 50·8	77·3 54·6	70·9 58·4	64·0 64·0
36	2484 36·5	1260 37·1	852·0 37·6	648·0 38·1	444·0 39·2	342·0 40·2	280·8 41·3	240·0 42·4	210·9 43·4	189·0 44·5	158·4 46·6	138·0 48·7	123·4 50·8	112·5 52·9	97·2 57·2	87·0 61·4	79·7 65·6	72·0 72·0
44	3036 44·6	1540 45·3	1041 45·9	792·0 46·6	542·7 47·9	418·0 49·2	343·2 50·5	293·3 51·8	257·7 53·1	231·0 54·3	193·6 56·9	168·7 59·6	150·9 62·1	137·5 64·7	118·8 69·9	106·3 75·1	97·4 80·2	88·0 88·0
52	3588 52·8	1820 53·5	1231 54·3	936·0 55·1	641·3 56·6	494·0 58·1	405·6 59·6	346·7 61·2	304·6 62·7	273·0 64·2	228·8 67·3	199·3 70·4	178·3 73·4	162·5 76·5	140·4 82·6	125·7 88·7	115·1 94·8	104·0 104·0

This table gives, in inches, the distances from lens to object (greater conjugate focus, upper number) and from lens to ground glass (lesser conjugate focus, lower number) for different heights of images and different lengths of foci of lenses, when the height of object is 68 inches (=average height of man).

EXAMPLES.

Q.—What is the height of image of a person who is 133 inches distant from lens, when a lens of 14 inches focus is used?

A.—The height of image in this case is 8 inches.

Q.—What are the distances between object, lens, and ground glass if the image of a person is to be 8 inches high and a 14 inches focus lens is employed?

A.—The distance from object to lens will be 133 inches, from lens to ground glass 15·6 inches.

TABLES OF DISTANCES AT AND BEYOND WHICH ALL OBJECTS ARE IN FOCUS.

SIR D. SALOMON'S TABLE.

Focus of Lens in inches.	Ratios marked on Stops.													
	f/7	*f*/8		*f*/10	*f*/11	*f*/12	*f*/13	*f*/14	*f*/15	*f*/16	*f*/17	*f*/18	*f*/19	*f*/20
	Number of feet after which all is in focus.													
4	19	17	15	14	13	12	11	10	9	9	8	8	7	7
4¼........................	21	19	17	15	14	12	11	11	10	10	9	9	8	7
4½........................	25	22	19	17	16	15	13	13	12	11	10	10	9	9
4¾........................	27	23	21	19	18	16	15	14	13	12	12	11	10	10
5	30	27	24	21	19	18	17	15	14	14	13	12	11	10
5¼........................	33	29	25	23	21	20	18	17	16	15	14	13	13	12
5½........................	37	31	29	26	23	22	20	19	17	16	15	15	14	13
5¾........................	39	34	31	28	26	24	22	20	18	18	17	16	15	14
6	43	38	33	31	28	26	24	22	21	20	18	17	16	15
6¼........................	47	41	37	33	30	28	26	24	22	20	20	19	18	17
6½........................	50	45	40	36	33	29	28	26	24	23	21	20	19	18
6¾........................	55	48	43	39	36	32	30	28	25	24	22	22	21	20
7	58	52	45	42	38	35	31	30	28	26	25	23	22	21

DR. J. J. HIGGINS'S TABLE.

Equivalent Focus.	*f*/5	*f*/6	*f*/7	*f*/8	*f*/9	*f*/10	*f*/11	*f*/12	*f*/13	*f*/14	*f*/15
5 inches............	42	35	30	26	23	21	19	17½	16	15	14
5½ ,, ...	50½	42	36	32	28	25	23	21	19	18	17
6 ,, ...	60	50	43	38	34	30	27	25	23	21	20
6½ ,, ...	70½	59	50	44	39	35	32	29½	27	25	23½
7 ,, ...	82	68	59	51	45	41	39	34	31	29½	27

Calculated for a Confusion Disc of less than $\frac{1}{100}$ of an inch.

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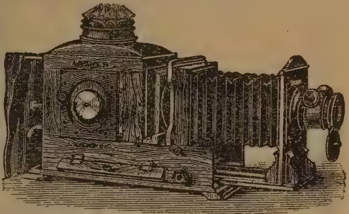

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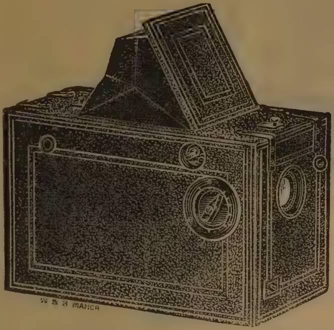

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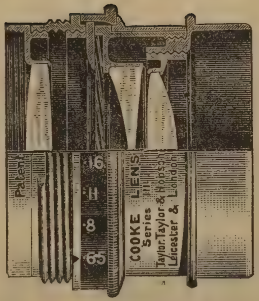

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